Electrical Review

With Which Is Consolidated WESTERN ELECTRICIAN and ELECTROCRAFT.

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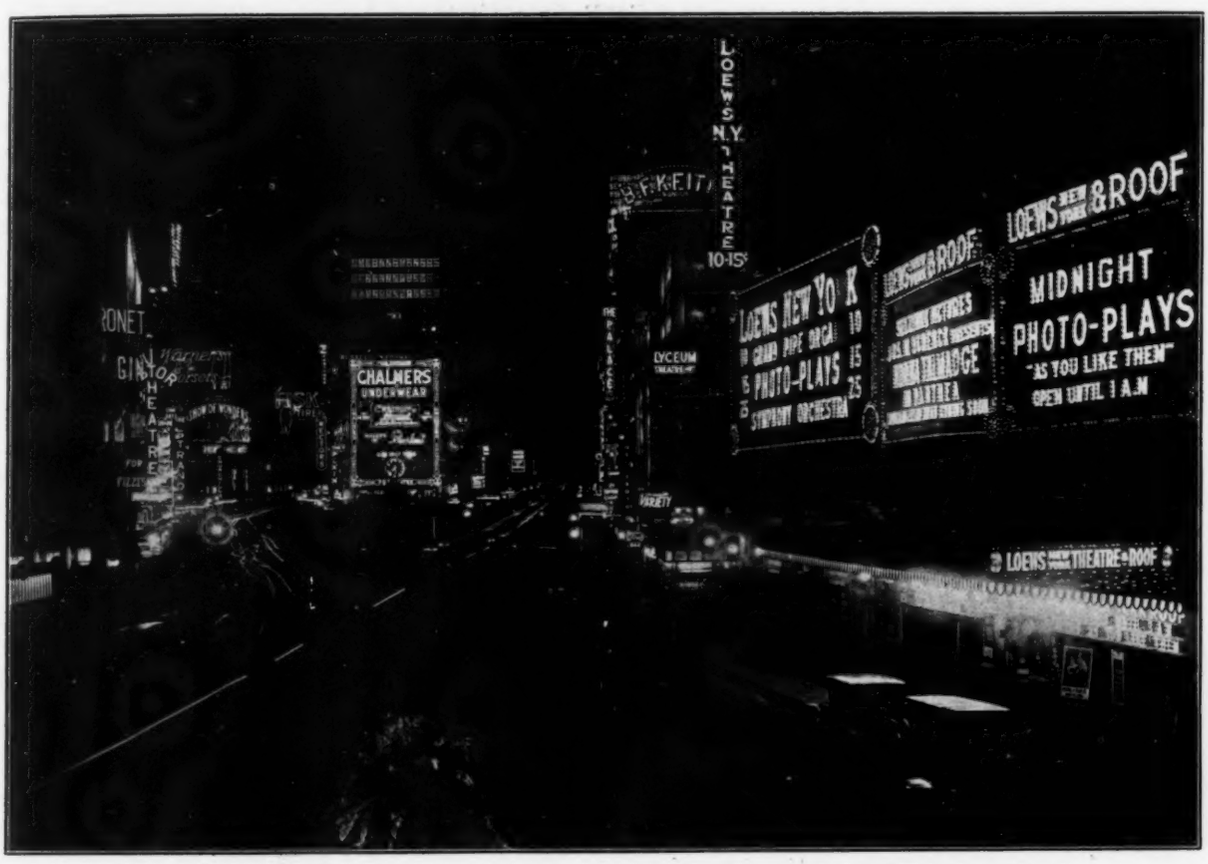


Broadway, New York, Which Is Now Dark on Thursday and Sunday Nights.

ALMOST fitting and graphic illustration of one of the effects of the war on the electrical industry can be visualized from the above view which shows a section of Broadway, New York, in all of its glory. This famous thoroughfare, which is one of the show places of the world, is famed for its sign and decorative lighting. The Federal Fuel Administrator plays no favorites, however, and on Thursday and Sunday nights of every week Broadway, too, is shorn of its glory. The reader can easily imagine how the above scene would appear if all the signs were darkened.

Actually, the so-called "lightless" night order has had very little effect on the electrical industry. There is, of course, an appreciable saving in coal when the country is considered as a whole, although the effect on the revenues of individual companies is negligible. It has been necessary, however, to revise rate schedules in those cases where a flat rate was in effect for sign or decorative lighting.

As pointed out on previous occasion, the most important phase of the "lightless" night order is the moral effect it is having in emphasizing the seriousness of the situation confronting this country and in encouraging economy. In this commendable cause, the utility companies are willingly co-operating.

In the reviews which follow, an effort has been made to summarize the real effects of the war on the industry and to point out what lessons must be learned from the experiences of 1917.

Attention is particularly called to the statistics on page 17 which give the estimated value of electrical products manufactured during the year. Although certain branches of the industry suffered during the latter part of the year, because of the difficulty in raising capital, high prices for material and general tendency to curtail normal development, the industry as a whole has made a remarkable showing and the total figures on 1917 production are far in excess of any previous year.

Electrical Progress and Tendencies in 1917

A General Review of the Year's Advances in the Principal Branches of the Electrical Industry—Important Influences of the War

By ALBERT SCHEIBLE

AS WAS to be expected in view of existing conditions, the year 1917 was not a year of sensational developments. The influence of the European war, as already exerted for several preceding years, has continued to affect every phase of electrical activity, and during the past nine months this influence has been augmented in many directions by the entrance of the United States into the struggle. Indeed, the same general tendencies which operated during 1916 have continued effective to such an extent during the past year that the reports of a year ago as to the conditions and the trend in many lines of electrical activity apply much more adequately than they probably would have done after 12 months under normal and peaceful business conditions. Moreover, the preoccupation in war matters of so many of those most prominent in the electrical industry has made it abnormally difficult to obtain such summarized data as have conventionally been reported at the close of the year, while the exigencies of the war and the consequent need of suppressing information which might be of aid to the enemy also are decided handicaps in any attempt at adequately reporting the developments of the past 12 months. However, 1917 has by no means been a year of stagnation in electrical matters, and a series of birds-eye glimpses at numerous branches of electrical activities should afford both an interesting backward look and a stimulus for progress during the new year.

The Industry Does Its Bit.

Joining hands heartily with men in other lines, the men of the electrical industry certainly made a fine response to every call that has come in connection with the participation of this country in the war. The millions of dollars promptly subscribed for Liberty bonds, the correspondingly large Red Cross and Y. M. C. A. contributions, the ready enlisting of thousands of electrically trained men in the signal and engineering service of the army, the hearty enrollment of electrical men of prominence in unpaid government service, and the ready co-operation of central stations toward effecting war-time economies even with the obvious prospect of thereby curtailing their revenues, all tell their own story.

Of course, some branches of electrical activity have profited considerably, as by the furnishing of millions of dollars' worth of war equipment and supplies, but at least in general, neither manufacturers nor dealers can be said to have followed the lead of many other lines by unfairly raising the prices of their products. On the contrary, manufacturers have taken pains to curtail waste and keep down operating expenses, so that the advance in the price of electrical supplies has not been in proportion to the increased cost of material and labor. Perhaps this is all the more notable and admirable in view of the enormous demands made upon prominent manufacturers for materials required by the Government, demands which have led to large increases in many of the leading factories during the past year. Quite in harmony with this general spirit, though otherwise to be regretted, was the canceling of the annual convention of the National Electric Light Association, which was to have been held late in May at Atlantic City and for which some 25 sessions as well as an unusually large and highly educational exhibit had been planned.

Electrochemistry and Electrometallurgy.

HOWEVER, electrical features formed a notable part of the third National Exposition of Chemical Industries, held at New York City during the closing week of September, an exhibition which wisely was held in spite of war conditions, since so much of America's war successes, as well as of her after-war industrial standing, will depend on her immediate progress in chemical industries. To an observer from the electrical field, three points stand out in connection with this exhibition and the meetings held coincident with the same.

One is the remarkable progress made by this country in electrochemical research and industry, for the past quarter of a century has brought a supremacy for the United States in electrochemistry, comparable with that achieved in dye products and fine chemicals by Germany. (Incidentally, attention was quite properly called at the time of this exhibition to the probable shifting of this supremacy to Canada and Norway after the war, unless prompt steps are taken by this country towards utilizing more Niagaras.) A second was the many-sided importance of the metal which popularly is often assumed to have only its one notable use in incandescent lamp making, namely, tungsten, a metal of such diversified service in connection with the war that the president of the American Electrochemical Society has referred to it as "the key metal for making democracy possible."

Progress in Use of Electric Furnaces.

Equally notable, and far more important to those interested in the sale of electric current, was the attention given at this convention to electric furnaces, though the same only reflected the remarkable activity shown along this line during 1917. Indeed, the annual convention of the American Foundrymen's Association (held at Boston in September) devoted an entire session to the use of electric furnaces, it being reported that about 200 electric furnaces with an annual capacity of 1,200,000 tons of steel and a prospective energy consumption of 750,000,000 kilowatt-hours had been either installed or contracted for, in North America. The sensational prices offered for various ferro-alloys, as compared with the prices of four years ago, had proven a logical stimulus to such activity, and in the case of ferro-manganese, this advance in price had been such that coke no longer maintains its advantage over electric heat. Moreover, the use of the electric

furnace will permit the utilizing of low-grade manganese ores, such as those found in Arkansas and Tennessee, some of which are to be reduced by power to be furnished from the hydroelectric plant at Keokuk.

Electric furnaces have also grown in demand and use for other smelting operations. Thus, the scarcity of good crucibles, due to the handicapping of the graphite importations from Europe and the lack of the German clays, has stimulated the demand for electrically heated furnaces for copper and bronze. Experiments now being conducted in this country with a view to adapting such furnaces also for brass are being watched with keen interest. Moreover, the use of electric furnaces for melting iron has been stimulated during the past year by the saving in labor through the pouring of castings directly from the furnace, as by carrying the molds to the furnace on a conveyer.

In Europe the use of electric furnaces for the synthetic production of nitrates has increased during the past year, and various changes have been developed. Thus, a 50 per cent greater yield is claimed in such operations for three-phase furnaces than for the single-phase furnaces formerly used.

Hydroelectric and Central-Station Progress.

CLOSELY allied to such a production of nitrates in electric furnaces is the fixation of nitrogen from the air by means of the electric arc. With the urgent need of nitrates for war purposes as well as for fertilizers, it had been expected by many that the Government would take steps during the past year towards the erection of suitable hydroelectric plants of large capacity. However, the Nitrate Supply Committee appointed by the Secretary of War recommended the erection of a plant for making nitrates in the form of synthetic ammonia, afterwards to be oxidized to nitric acid, but made according to a new American process without the use of the electric arc. This decision, though backed by good logic, was disappointing to many who had hoped that by adopting the electric arc process in conjunction with new water-power developments, the Government would relieve or readjust the present calamitous power situation.

As it is, hydroelectric projects remain blocked in their financing by the existing laws which allow the governmental permits to be revoked by certain cabinet officials without providing for any reimbursing of the investors in case of such revocations. Efforts to relieve this situation by congressional legislation have failed during the past year, but the prospects are good for definite action in the near future. However, both these efforts, as embodied in various bills, and the investigations made in connection with the work of the Nitrate Supply Committee have called renewed attention to some of the water powers, particularly in the South, which are capable of industrial development on a large scale, so that this agitation should bear fruit later on.

Meanwhile, the past year saw a continuation of hydroelectric development in various parts of the North, as in the starting of the new plant at Turner Falls, Mass. (which is ultimately to develop 50,000 horsepower at 6600 volts); the beginning of the development of a 20,000-kilovolt-ampere plant at Hiram Falls, Me.; the beginning of work for the Connecticut Light & Power Company on the Housatonic River, where a hydroelectric plant of an initial 18,000-kilowatt capacity and an ultimate 100,000-kilowatt capacity is being developed; and the enlarging of the hydroelectric plant for the municipal lighting system at Seattle, Wash.

INCREASED USE OF STEAM TURBINES.

While not handicapped by oppressively unfair laws, as in the case of hydroelectric projects, steam-driven central stations have continued to suffer from the difficulty in financing extensions. Hence the past year has been more notable for the economies practiced by lighting plants than for their extensions along the formerly customary lines. Foremost along this line and in harmony with the recommendations of the Government Fuel Administrator have been the efforts to reduce the fuel consumption.

For this purpose, direct-connected steam turbines have been introduced with satisfactory results as substitutes for steam engines, even in comparatively small sizes, such as 200 or 250 kilowatts. Likewise, the size of turbogenerator units for large plants has been increased, as evidenced by units ranging in size from the 25,000-kilowatt units adopted at St. Louis and at Minneapolis, to the 30,000 and 35,000-kilowatt units installed at Boston, Chicago (Commonwealth Edison Company's Northwest Station), and at Essex (Public Service Electric Company of New Jersey), to the 40,000-kilowatt cross-compound turbo unit of the Brunots Island Station of the Duquesne Light Company in Pittsburgh.

BOILER-ROOM ECONOMIES.

In line with this necessity for saving fuel, the urgency of which need hardly have been pointed out by the fuel administrator in view of the difficulty experienced by many plants in maintaining an adequate reserve of fuel, have been the increased use of low-grade fuels, and of special equipment for utilizing both high and low-grade fuels effectively and with a minimum of labor. Investigations as to the use of lignite as a substitute for coal also promise results in certain limited sections of the country, and the instructing of employees in using fuel more economically has been energetically undertaken by prominent central-station operators, as for example by Mr. Doherty. Likewise, the year developed a tendency towards using higher steam pressures as a means of increasing the thermal efficiency. Coal and ash-handling equipment, mechanical stokers and other apparatus for relieving the work of the firemen has also come into much more extensive use.

DISTRIBUTION ECONOMIES.

While the continued high costs of material and labor have retarded line extensions, the steady demand for added service has driven a great many central stations to new expedients for taking care of the added patronage at less than the customary expense. Iron wire has been used extensively in many localities and during the year was formally approved by the State Public Service Commission of Connecticut for voltages ranging up to 4400 (and in one case up to 13,200 volts) and for spans of not over 125 feet. However, such a use of iron in place of copper has been found to introduce new problems, as, for example, a decided increase in the charging current in proportion to the load, which problems have only partly been studied.

In this connection, it is interesting to note that the reduction in the price of copper by governmental orders came in the face of the prediction made last March by an official of the United Metals Selling Company that no lower price of copper was in sight; as also the advance in the cost of insulating materials, offsetting the reduction in the price of the copper.

Necessity has also developed the fact that distribution systems can sometimes be made adequate for decidedly increased loads by a remodeling and rearrang-

ing of the same; as at Detroit, where a considerably greater capacity was obtained with an actual reduction both in the amount of line material and in the transformer capacity. Likewise, static transformers have grown in favor as boosters, affording substitutes for the additional wire otherwise required to overcome the line drop. So, also, the systematic testing of line insulators, as inaugurated by the Pacific Light & Power Corporation, and the use of meggers for testing supplies of transformer oils, deserve mention as means for reducing transmission losses.

Other Central-Station Tendencies.

One of the noteworthy trends during the past year has been that towards interconnecting generating plants, both for the sake of effecting operating economies and for enabling any of the interconnected stations to take care of abnormal demands. In some instances, as in the case of the Philadelphia Electric Company, this has meant the interconnecting of its own plants in the rapidly developing manufacturing district between Philadelphia and Chester. In other cases it has implied the interconnecting of plants differing as to generating capacity and load-factors. For the latter purpose the plants at Salem, Malden and Revere (all in Massachusetts) were suitably interconnected by tie lines during the past year, thus enabling either the Malden or the Revere plant to be operated more efficiently at certain seasons of the year, and also enabling these plants to sell energy to the Salem company when the demands on the latter exceed its capacity.

Among other practices noted during the past year was that of selling current in bulk to former companies who construct their own transmission lines, as successfully inaugurated by the Wisconsin River Power Company, and the installation of automatic hydroelectric plants as auxiliaries to regularly manned stations, as at Cedar Rapids, Iowa. Also, the placing of service bus wires in conduits run inconspicuously along building fronts in residential districts to relieve both streets and yards of unsightly wiring, while avoiding the expense of underground construction; and the tendency towards discontinuing the gratuitous replacing of incandescent lamps. The urge of economy has also started the adoption of bimonthly billing by some central stations, and the rendering of joint bills for gas and electric light service by companies supplying both services.

Electric Transportation Developments.

WHILE disappointment is expressed on many sides at the limited headway made during the past year by electric vehicles, there still has been progress in numerous ways, and with the climbing cost of gasoline, the new year may see more of it. Efforts towards standardizing such vehicles have shown good results, while the handling and interchanging of batteries for auto-trucks has been standardized and expedited. Vacuum-jacketed battery boxes (operating after the manner of so-called thermos bottles) have been introduced for reducing the effect of cold weather on the battery capacity, and central stations have been effectively urged to utilize vehicle battery charging as a means of filling in the valleys of their load curves. In Chicago a guaranteed electric-truck service has been inaugurated by the central-station company.

Perhaps the most notable use of electric vehicles during the year has been in the form of tractors for hauling trucks or cars in munition factories and at freight depots, in which latter connection they have proven admirable aids towards relieving the congestion which has so seriously handicapped the railroads during the past season. Electric vehicles have also been introduced both in this country and abroad in the form of coal trucks, while storage-battery locomotives have been extensively adopted by the Calumet & Hecla Mining Company for underground rock hauling.

Urban and Interurban Lines.

As the use of automobiles had not yet been curtailed during 1917 by any war measures, interurban lines have still felt the loss of the local passenger traffic which was diverted from them some years ago. In view of this, and of the effect of the war in reducing the number of employees, there has been a growing introduction of one-man cars, which were installed with very little complaint and with a decided curtailing of operating expenses at Spokane, for instance. Lighter-weight motors have been developed for use on the one-man cars, which are built of considerably lower weight than the older types of the same seating capacity. As another means of overcoming the dearth of skilled labor, the American Electric Railway Association urged apprentice courses.

Electric freight hauling received considerable impetus from the railway congestion of the past year, and some street railways (as, for example, in Massachusetts) profited by the opportunity, while Mr. Doherty urged the night hauling of freight as a means of increasing revenues. Mergers of street-car systems have continued to be numerous, longer-range electric light signals have been developed, and portable electric welders were introduced for use in bonding rails. Considerable attention was paid during the year to car ventilation, extensive tests being made as to the air conditions in street cars operated both with and without special ventilating appliances.

Railroad Electrification.

In February, the Chicago, Milwaukee & St. Paul Railroad (the first railway in this country to appreciate and utilize the advertising value accruing from electrification) took the last steam-operated train off its Missoula division, and in May the same railway began electrifying another division, comprising 217 miles, for which power is to be furnished through eight substations by the Intermountain Power Company. The Great Northern Railway began construction of a dam at the foot of Lake Chelan and of a power station on the Chelan River, as also of the pole lines for transmitting 150,000 horsepower to operate the company's lines from Spokane to Seattle.

The Lehigh Valley Railroad had its engineering department investigate as to the proposed electrifying of its main line (176) miles between Jersey City and Wilkes-Barre, and of another 52-mile division. The Canadian Northern Railway was reported as proceeding with the electrification of its ten-mile entrance into Montreal.

Notable new equipment ordered during the year included new passenger locomotives for the New York, New Haven & Hartford Railroad, for use interchangeably on an 11,000-volt trolley and on a third-rail portion of the track, each locomotive having 12 motors divided into four groups and arranged for multiple-unit operation. Electric locomotives somewhat similar to those used by the Chicago, Milwaukee & St. Paul Railroad were furnished early in the year by the General Electric Company for the Bethlehem-Chile Iron Mines Company in South America, these being also fitted with regenerative-braking equipment to pro-

vide for adequate control on heavy down grades. On the other hand, the new powerful locomotives designed for the Pennsylvania Railroad are to transform the single-phase trolley current into three-phase energy, thereby utilizing induction motors in which no extra equipment is required for regenerative braking.

Electric Power for Industrial Works.

IN LOOKING back at the records made in various sections of the country in the electrical equipping of cantonments, munition plants, and other enterprises due to the war, the observer is puzzled as to which to admire most, the alacrity with which the installations were accomplished, or the fine judgment and high engineering skill evidenced by the same. The latter has been particularly noticeable in the equipping of munition plants and other factory buildings, where dependability of service, as well as economy and facility of operation had to be considered. With this in mind, the relative advantages and limitations of group electric drives and of individual motor drives have been studied more extensively than heretofore; as also the advantages of employing several motors instead of a single one for jointly furnishing the power for a given group of machines, thereby enabling a higher motor load-factor to be obtained.

Likewise, the substitution of electric for mechanical driving to increase the output of a factory has shown it to be advisable in many cases to cut the existing shafting into sections and to provide separate motors for each section. Manufacturers of machine tools have co-operated much more extensively than heretofore in properly equipping their products with direct-connected motors, so that the past year's activity along this line should show a lasting effect on machine-tool practice.

Growing Use of Electric Labor-Saving Devices.

Moreover, a systematic study of the factory requirements in the light of the labor situation has led to the introduction of motor-driven labor-saving appliances to a much larger extent than heretofore, while both magnetic clutches and distant-control starting switches have contributed towards increasing the safety of the installations, and the ability to employ unskilled men or those of lower mental caliber, if necessary.

New electrically operated tools have been devised for expediting many classes of work, as, for example, in the cutting of steel plates in shipyards by an electric arc or the oxy-acetylene flame, where an electric motor automatically moves the cutting tool either in a straight line or in a circle, according to the adjustment of the tool. Magnetic separators have grown in use until they are now employed in 25 different industries, and lifting magnets considerably extended their field of usefulness during 1917.

Electric Telpherage.

Electric telpherage also made decided strides, both at the war fronts and elsewhere. The rapidity with which electrically operated telpherage lines were erected in mountainous districts both by the French and by the Italian engineer corps, and the capacity of such speedily erected equipment for handling munitions furnished long desired object lessons. Likewise, the completion of the telpherage installation near the Nevada boundary in California for handling salt for a distance of more than 13 miles over a mountain range from the Saline Valley, demonstrated the value of telpherage in industrial operations.

Progress in Electric Lighting.

UNUSUALLY fine accomplishments, both in the high character of the installed lighting equipment and in the alacrity with which it was put into service have also been shown during 1917 in the lighting of new factories for munitions and the like, and more recently in the lighting of cantonments. The same delays in securing duplicate machine tools, which prevailed in the two preceding years, forced the substitution of night shifts for factory extensions, and during the past year both central stations and manufacturers of lighting appliances have profited by this opportunity. Factory lighting has been studied as never before, and good lighting has come to be more generally appreciated both as a means for increasing factory output, as a factor in industrial safety, and as a preventive of spoilage. Moreover, factory lighting has been considered more as to service and operating cost rather than from the initial cost of installing the same.

Store lighting has also shown advances and filtered light has been more extensively and intelligently used, since the high efficiency of the modern incandescent lamps enables the user to afford such losses as are implied by color filtration. Carbon-dioxide lamps have proven effective for color matching, and lighting units suitable for color matching have been offered even in portable types for counter use. Tungsten lamps for use in motion-picture projection have been developed in 30-ampere (25-volt) and 20-ampere (30-volt) sizes, each with an effective life of 100 hours, but suitable only for short-range projection.

Outdoor Lighting.

Flood lighting continued its rapid progress of the preceding year and found new applications as in cantonments, for lighting flags, for lighting pole-line sections to facilitate repairs after dark, and for illuminating statues in parks. Flood-light projectors were also used largely in connection with the protective lighting of industrial plants, public utility plants, government works and other establishments likely to tempt the ire of treasonable aliens. Reports as to many of these protective-lighting installations show a systematic planning, with due consideration for the shading of the lamps in one direction, and with the deliberate employment of glare in other directions as an aid in confusing trespassers.

In street lighting, more attention was also paid to glare, silhouette effects and reflection effects as bearing on the service. Tungsten lamps continue to replace arc lamps, and the tendency toward a higher mounting of the lamps has also continued. The prospects of curtailing street lighting to save coal have brought the recommendation that the lighting be continued only from one side of the street, as an alternative to the crime-stimulating complete darkening of the streets on certain nights. The curtailing of sign-lighting hours and the promulgation of Sundays and Thursdays of each week as "lightless" nights have already affected the revenues of central stations, but the threatened "daylight saving" plan has not yet been adopted in this country. If adopted in 1918, it may offset partly the increase in loads due to the night shifts in manufacturing plants.

Electric Cooking and Heating.

ONE of the features of the year was a decided progress in the widespread introduction of electric ranges. Central stations have wisely catered to

this class of loads, and many of them conducted special electric-range campaigns with success. As the result, it is now estimated that over 14,000 electric ranges are in use in this country, stimulated in large measure by the special rates of 5 cents (or even less) per kilowatt-hour as offered in over 4,000 communities for electric cooking ranges.

Electric-cooking equipment has also been adapted to the needs of the army, both in stationary and portable outfits. Notable among the latter is a camp cooking equipment, reported as adequate for 500 men, which includes ovens mounted on an automobile and supplied with current from a generator driven by the engine of the vehicle.

Electric heaters continue to find new industrial fields, as proven at the Ford assembling plants at Chicago and elsewhere, where electric enameling ovens have increased the daily output and reduced the needed labor; and as also proven on the war front, where the beneficial action of electric bed warmers is reducing the mortality among the seriously wounded.

Electric Welding.

In electric welding, the situation has been somewhat disturbed by the litigation over spot welding, but the great saving in labor effected by various methods of welding is continually extending its range of applications and many new tools have been devised during the year for expeditiously welding (or in some cases, electrically soldering) materials of different shapes.

Arc welding has been successfully introduced for the welding of cast-iron pieces in thicknesses exceeding one-fourth of an inch, and the safety of the workmen has been increased by the use of hoods which combine glare-eliminating eye shields with mechanical protection for the entire head. Incidentally, such new safety provisions constituted only a part of the general progress in safety methods throughout the electrical industry, a progress due in large measure to the effectiveness of various safety conferences and committees.

Electrical Contracting and Merchandising.

FOR the contractors, an epoch-making event was the adoption (in October) of the so-called Goodwin plan for reorganizing the National Electrical Contractors' Association, which aims to include practically all of the 25,000 electrical contractors and dealers in the country. More interest in electrical merchandising has been roused in the contractors, and in many sections they have also been stimulated to cater to farm-house wiring, thereby working hand in hand with central stations and with dealers in farm-lighting outfits. The year also brought a concerted action from many quarters towards further training of electrical contractors to include an adequate allowance in their estimates for overhead expenses, as for example by adding fifty per cent to the costs of the material and labor.

Among the electrical jobbers, one of the important developments of the year was the interest shown in the use of trade acceptances as means for expediting collections and for making outstanding accounts more liquid as assets. Although the use of trade acceptances had been approved and urged long before under the terms of the Federal Reserve Banking act, it took the financial conditions of the past year to force the subject to a front, and it formed the most absorbing topic at the November meeting of the Electrical Supply Jobbers' Association.

Another feature of the year was the increased stimulation of electrical merchandising by extensive advertising in popular periodicals of wide circulation, and through unusually effective window displays, as also by employing women in place of men for selling household articles. The former jealousy between dealers and central stations as to the selling of electrical merchandise appears to be waning, undoubtedly due, at least in part, to more insistence on the part of central stations that their appliance departments should operate at a profit.

Among the exploited articles, electric dishwashers and refrigerators for household use made notable progress, while electric fans were available in a greater range of sizes than formerly. Electric water heaters entered the field more energetically for both kitchen and bath-room use, and special window lamps for use with Red Cross emblems were sold for use on Christmas eve. Moreover, the extended range of applications for small motors, notably in the fractional-horsepower sizes, showed its effect.

Wire Telephony and Wireless Telegraphy.

IN the telephone field, both the shortage of materials (due largely to the priority afforded to the war needs) and the withdrawal of a considerable proportion of the trained help retarded the normal growth of business. Consequently, the usual monthly reports of both Bell and independent telephone companies have lately been showing a decrease in the net operating revenues, and this condition should lay the basis for a readjustment of rates in many localities. Rate investigations have continued during the year, one notable result being the approval, by the Pennsylvania Public Service Commission, of measured service as a basis for fixing the charges for business telephones in the larger cities.

Anticipating the entrance of the United States into the war, various departments of the Bell system had not only laid their plans for meeting the abnormal requirements, but had actually made a three days' test of mobilized communication of forces, with the cooperation of the Navy Department. Consequently, the unusual demands on the system were met with satisfaction, approximately 10,000 miles of wire being diverted from commercial use and some 12,000 long-distance operators being trained for the work. A new underground cable containing 80,000 miles of wire is being installed between Washington and New York, and telephone facilities have been provided speedily for all of the cantonments. Telephone communication for the coast-guard system has been reorganized and is being greatly extended, while telephonic connections are also used in the guarding of bridges, water-supply systems, and the like.

On the war fronts, telephone communication continued to play an important role, although the frequent interruptions of the service even when operated through underground wires have lately brought short-range wireless apparatus into favor as a substitute for part of the telephone lines.

Radio Service in the War.

The suppression of unauthorized wireless plants by the Government brought consternation to hosts of amateurs, but the heavy enlistment of such operators has proven their loyalty. At the war fronts, the Germans were lately reported as using short-range apparatus in preference to telephony to avoid interruptions to the service, and to be graduating the strength of the stations from small storage batteries to electric generators, according to the desired range. The effectiveness of aviation continues to be extended by the

use of wireless apparatus, which has proven its value in reporting approaching cyclones as well as in transmitting information about the enemy.

One effect of the war has been a tendency to standardize apparatus. By substituting nitrogen for air to prevent the burning out of the filament, audion detectors have been constructed to work at all pressures up to that of the atmosphere. Other developments are also understood to have been made during the year, regarding which information is withheld.

Photo-telegraphy after the method of Dr. Korn is reported as having been commercially perfected in Europe. Indeed, it was reported early in the fall that it was proposed to use this system for the telegraphic transmission of pictures on the Berlin-Vienna-Sophia-Constantinople-Bagdad route, utilizing the usual telegraphic or telephonic connections.

X-Rays, Electrotherapeutics and Other Scientific Developments.

ROENTGENOLOGY also made decided progress during the past year, its widely extended use having been made possible by the Coolidge tube. The radiographing of teeth and gum tissues has been standardized for army purposes, and, at least at certain of the camps, complete sets of radiographs for every recruit are being taken with a view to locating any concealed sources of infection. Behind the war fronts, X-ray apparatus is being used for investigating injuries, locating imbedded bullets and shell fragments, and for detecting the nature and direction of bone fractures.

The past year also extended the usefulness of the Roentgen rays considerably beyond diagnosing. Radiation treatment with such rays is being employed in Europe for making scar tissues pliant, for depilating scalp and skin surfaces, for rendering flaps more adaptable to new positions, and for generally stimulating certain healing processes. Cases of muscles paralyzed by gunshot wounds of the nerves, reported by some as constituting about half of the war injuries, are now both diagnosed and treated by electrical methods, as for example by applying continuous and interrupted currents and condenser charges. "Trench feet" also were reported as benefited by electrical treatment, while electrically driven cutters were devised for rapidly removing plaster of paris dressings and for cutting bandages.

Non-applied Science.

When this country entered the war, the immediate pragmatic effect tended to concentrate all scientific research upon such lines as would show a direct bearing on the serious problems of the day, thus tending to suppress research work in pure science. But, instead of submitting, a considerable number of the prominent scientists in this country accepted the challenge and have retaliated by pointing out the extent to which the most modern war methods, both of offense and of defense, have been indebted to research work conducted without thought of its practical applications. Consequently, the past year surprised many by the calm continuing of such researches and of the related discussions. Noteworthy among these have been further investigations into the detaching of the electron and the nuclear structure of atoms, and an interesting symposium on the latter topic.

However, scientists have also responded heartily to the calls of the Government, and large numbers of those whose names have heretofore been associated mainly with theoretical and non-applied experimental work were among those enrolled in investigations for directly furthering war purposes.

Electrical War Auxiliaries.

While a large part of the electrical developments of the past year may not be made public for some time, in so far as they relate to the conduct of the war, enough has been publicly observed to indicate the wide scope of such investigations and developments. Notable among them was the installation of electric propulsion in the new battleship *New Mexico,* which in turn was prompted by the satisfactory earlier use of electric propelling means on the collier *Jupiter.*

Electrical means for detecting enemy maneuvers have engaged the attention of many, both with a view to locating submarines and for detecting tunneling operations. On the other hand, much thought has also been given to reducing the magnetic whine of ship machinery, so as to retard the use of magnetic detectors by the enemy. Static charges on airships also are being studied, both with a view to detecting and to preventing the same, and the resulting developments in this and allied lines should prove of high value also in times of peace.

Indeed, even comparatively simple appliances are receiving highly skilled attention, as in the case of the flashlamps which now form an indispensable part of the equipment of officers and others along the war front, and the use of which is stimulating primary-battery developments of far reaching purport.

Foreshadowing Coming Changes.

OTHER observations also show the beginning of practices during 1917, which will undoubtedly prove more noticeable during the coming year. For example, the employing of crippled soldiers in Great Britain as central-station attendants, and of the blind by the Crocker-Wheeler Company for taping armature coils, both indicate industrial changes which may reach a considerable magnitude during 1918.

Likewise, the successful utilization of the Cottrell process for the electrostatic precipitation of the fine dust which has heretofore been both a nuisance and a source of loss in cement mills and blast-furnace plants, proves anew that war conditions, instead of stifling progress during the coming year, should stimulate activity along new lines where its usefulness will be practically independent of the general world conditions.

PRESIDENT LIEB TO ADDRESS OHIO NEW-BUSINESS MEN.

Will Be Principal Speaker at Dinner in Dayton Under Auspices of Ohio Electric Light Association.

In connection with the next convention of the Committee on New Business Co-operation of the Ohio Electric Light Association that will be held in Dayton on Wednesday, January 16, the electrical interests of that city are arranging a dinner to be held in the evening and they have already secured the consent of President J. W. Lieb of the National Electric Light Association and chairman of the Committee on Gas and Electric Service of the Council of National Defense, to deliver the principal address on that occasion.

This will be President Lieb's first appearance in the Middle West since his election to the presidency of the Association and it is expected there will be a large number in Dayton to hear him on this occasion and also to attend the interesting convention that is being arranged for that day.

The Central-Station Industry in the War Period

Gross Earnings Total $500,000,000 for Year—Domestic Service Increases—Coal Cost Makes Rate Increases Necessary—Hydroelectric Development Encouraged

By T. COMMERFORD MARTIN

Secretary, National Electric Light Association.

THE central-station industry has naturally exhibited many effects as a result of the world war, since 1914, in both the commercial and the engineering fields, but it can hardly be said that any particular condition made itself very pronounced until 1917. Even now the processes of change have hardly begun to influence the art to such an extent as to show what its real future is likely to be. Broadly speaking, the commercial advances have been maintained at the usual high rate of increase. Of the great national prosperity that began in 1915 and still continues, the central station has had the fullest of shares, evidencing once again how deeply it has developed vital functions and entered into modern service to supply some of the great necessities and conveniences upon which civilization is based.

T. C. Martin.

The status of the industry as a whole may be gauged by its general activity, and the central station was certainly never more pushed to capacity than now. Such data as are available would indicate that gross earnings from the sales of energy and service have reached during 1917 the enormous total of $500,000,000. The gross total income reached $175,642,338 in 1907 and $302,115,590 in 1912, hence nearly doubling in the five-year period, at which rate it might easily be in excess of half a billion for 1917. An average gain from month to month in the year has been at least 12 to 15 per cent, and in numerous individual instances much higher. Such figures are eloquent as to the general demand for electric light and power in one or other of their manifestations.

Will development of this kind continue in 1918? Who knows? Is any one prepared to say that it has been checked? Will the fuel famine have continuance? Will it not, where felt, be offset by higher generating economies as well as by the use of more economical lamps, motors and other consuming appliances? At the moment, there is a restriction in the lighting field which possibly may intensify in 1918, but it is vastly overborne by the tremendous demands for electrical energy in mill and mine and factory, in all manner of electrochemical processes, some of which were scarcely known here before the war. The central station once lived by light alone. A street-lighting contract was the very essence of its being, and "diversity-factor" meant nothing. Now the permeation of all industrial branches and the requirements of social service have gone so far, it has become less a matter of extension into new fields than of saturation and intensification of existing ones.

Domestic Increases Continue.

While the central station may be said to have ceased for a time to drum up new business because it cannot take care of that which freely offers itself and even begs insistently for service, the industrial demand coming upon it cannot check the growth of domestic consumption. The reports of the member companies of the National Electric Light Association show an expansion of residential work. Every real home wants electricity, and those are rare which do not boast more than one appliance for lessening the burden and cost of family life. A recent compilation of data by the Society for Electrical Development would indicate a total of no fewer than 2,309,989 residences wired, for a population served of 23,828,420. This is not much more than one-fifth of the population of the United States, so that while it would be very unsafe to infer that five times as many residences throughout the country are wired, the implication is irresistible that the actual number must be much higher. In the United States Census returns of 1912, the number of meters on consumption circuits was reported as 3,617,189, which with an annual gain around 10 per cent would give us possibly over 6,000,000 meters installed at the end of 1917.

Moreover, the central stations have undoubtedly taken over many isolated plants. The tendencies of the times are against such plants unless of great size with all the modern refinements in producing energy. A significant indication of this is shown in the elec-

trical field itself, for the supply of energy by the central station to the local telephone exchange or telegraph office is quite the usual thing. The Western Union Telegraph Company alone has no fewer than 430 offices or local systems taking energy from central station circuits, inclusive of most of the large cities of the country.

So with the municipal plant. Of these very few new ones of any size now come into existence, for the ground is already occupied, and it is generally recognized that a duplicate, competitive plant of the kind is in the nature of intolerable economic waste. At the same time, another process is in evolution. As urban central stations have enlarged their networks and hydroelectric transmission plants at ever higher voltages have expanded their systems, it has become more and more the fashion to shut down the small local municipal plant and buy energy for its customers from these utilities. It is better business for everybody.

Rate Increases Necessary.

For a long time it has been a proud and justified boast of the central station that its commodity was the only one whose price kept going down while all other prices climbed steadily. On account of no fault of its own, but because every item of production cost during the last three years has risen spectacularly, the central station has had most reluctantly to revise its scale and ask for better rates. The justice of this has already been widely admitted, and several pages of the Association Bulletin *Rate Research* have lately been filled with the record of rate increases all over the Union. This will probably go on until the happier days of international peace restore us to normal conditions. Meantime it is obviously only fair to key rates upon the rise in the price of coal, as is being done frequently.

Water-Power Development.

The central-station industry is about to be benefitted, it is believed, by the prevalence of saner views as to water-power conservation, and the enactment of liberal laws, state and national, that will permit water-power development and invite capital to the task. A most deplorable chapter in the history of political agitation should now close. It is quite significant that the Government, for munition-manufacturing purposes, is now taking up eagerly such hydroelectric power developed by private enterprise and capital, in as large blocks as can be obtained. It would have been infinitely better off in this respect if legislation had allowed reasonable development and had not operated wholly in restriction and consequent waste. The promised change in the laws affecting such hydroelectric addition to central-station sources of supply is now overdue. The enactment of just and generous laws bearing on this question of the hour will be a most praiseworthy display of patriotism in American legislative halls.

Whether with circuits supplied from steam turbines or with those increasingly dependent on water power, the central station will pursue in 1918 even more vigorously than in the past its policy of grouping and districting. The holding company has been a necessary means to this desirable and logical end, and despite the opposition of those who could not see the inestimable value of its function, it has made its way. No pressure of events was needed here, as in England or Germany since the war, to cause the creation of a few large areas of electrical distribution, whereby the numerous small plants of the earlier regime have been swept away and their systems thrown into the melting pot for recasting. This tendency will now be emphasized, with a smaller number of stations and units of magnitude to correspond. Whole states can and will soon be supplied from five or ten plants where fifty or a hundred or even three or four hundred have been employed. In these directions will certainly go much of the electrical engineering of the near future.

Utility Financing by Stock Sales to Customers.

All such splendid work as this requires new capital, and the ordinary conditions of obtaining it do not prevail, although of late there has been marked success in the issuance of short-term notes. A bright augury is found in the success of plans for selling stock to employees and customers, whose participation in the utility as real partners is attended with almost unalloyed advantages. In the one case it is an added stimulus to vigilant loyalty; in the other it brings in a sympathetic relationship that minimizes harsh criticism. Out of both conditions must inevitably come a greater stability for the whole industry.

AMERICAN INSTITUTE MEETING IN BOSTON, NEW YORK AND CHICAGO TO DISCUSS WAR TOPIC.

Same Paper to Be Presented in Three Cities at Inter-Sectional Meeting.

The 336th meeting of the American Institute of Electrical Engineers will be an intersectional meeting held in Boston, January 8, New York, January 11, and Chicago, January 14, 1918. The same paper will be presented and discussed at the three places.

The paper to be presented is entitled "Effects of War Conditions on the Cost and Quality of Electric Service," by Lynn S. Goodman and William B. Jackson, and is given under the auspices of the Committee on Economics of Electric Service. The paper will be presented at the New York meeting by Mr. Goodman and at the Boston and Chicago meetings by Mr. Jackson. Non-members of the Institute who are interested in this subject are cordially invited to attend and take part in the meeting.

Rockford Installs Welcoming Sign.—A large electric sign has been placed on South Main Street, just south of the Chicago & North Western depot, Rockford, Ill., which reads "Rockford Welcomes You." The sign, located in the general depot section of the city, is designed especially to attract the attention of the thousands of visitors to Camp Grant, near Rockford. It was placed by the Flexlume Company, of Buffalo, N. Y. It will be used from 7:45 to 11 o'clock each evening, except on "lightless" nights. Energy is supplied by the Rockford Electric Company.

United States Leads in Electrical Trade With Canada.—The United States has practically a monopoly of Canada's import trade in electrical apparatus. Out of total imports valued at $6,342,400 in the fiscal year ended March 31, 1917, the United States supplied $6,149,342 worth; in the fiscal year 1916 the corresponding figures were $4,896,106 and $4,640,096; in 1915, $6,035,689 and $5,137,382; in 1914, $8,924,314 and $7,505,244; in 1913, $9,104,540 and $7,613,567. (In the last-named year the United Kingdom supplied $1,188,079 worth of the imports.)

The Effect of the War on Electric Lighting

Stimulation of Industrial and Protective Lighting—Intensified Research Work on War Lighting Problems—Curtailment of Lighting to Relieve Coal Shortage

By GEORGE H. STICKNEY

President, Illuminating Engineering Society.

FROM its very beginning the war has had a very marked, though changing, influence on lighting. This is not surprising when we consider the very close relation which illumination bears to every activity of life.

The declaration of war in Europe, in 1914, followed a period of financial depression and had the effect in this country of intensifying and prolonging it. Manufacturing establishments, on account of reduced business, curtailed their working hours and economized in artificial light as in everything else. Business concerns similarly reduced expenses wherever possible. Theaters and other entertainments either went out of business or limited their expenditures. The effect was felt even in the homes of the people, their churches and charities. Electric lighting naturally suffered.

Increase in Industrial Lighting.

With the arrival of war orders in the summer of 1915, manufacture and general business began to pick up rapidly, and the resulting prosperity brought demands for more light for both utilitarian and decorative purposes. During the latter part of 1915 the use of light increased so suddenly as to tax practically all branches of the lighting business to nearly their utmost capacity.

In 1916, many industries which but two years before had been working under daylight only, or used artificial light for short periods on dark days, began to operate night and day. This not only resulted in the use of artificial lighting systems 12 to 14 hours daily, but also made a demand for higher intensity and better illumination. Lighting that had been found acceptable for piecing out a dark day was found inadequate for all-night work. Thus the demand for energy and lamps expanded many fold. With the increasing prosperity the demands for light, especially in the luxury applications, grew correspondingly up to the spring of 1917.

Growth of Protective Lighting.

In the latter part of this period the dastardly attacks of Germanophiles directed at the manufacture and transportation of war materials led to the use of protective lighting arranged to keep out intruders. For such purposes, flood lighting, street lighting and other forms of equipment were used.

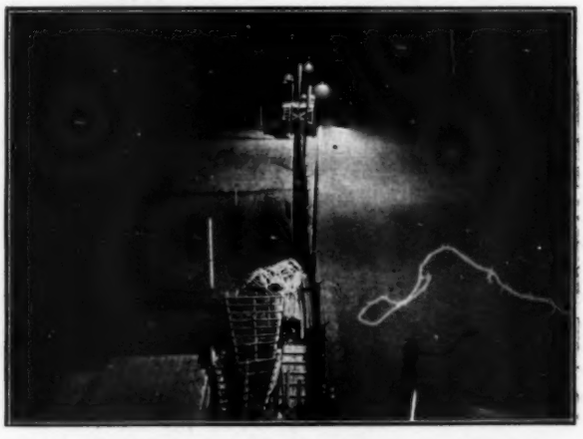
With the entrance of the United States into the war last April, an immediate change began to be felt. First, protective and flag lighting were in great demand. The protective lighting included not only manufacturing plants, trunk-line and other bridges, tunnels and docks, but all kinds of government works, water works, central power stations, etc., and is still increasing in use.

Decorative lighting suffered a sudden slump, the last important illumination effects of this sort being those at the President's inauguration. Then one by one decorative lighting installations were turned off. Industrial lighting was extended rapidly, followed shortly by new installations for cantonments and other war construction.

Lamp Development and Manufacture.

The intensive work necessary for applying light for special army and navy purposes led to much experimentation and the development of many incandescent lamps for particular purposes, especially beam projection.

With all these insistent demands, hampered by the delay and difficulty in securing materials, machines and operators, it has been all that the lamp manufacturers could do to supply lamps fast enough. In this



An Installation of Protective Lighting by Means of Dome-Reflector Units.

effort, the inefficient carbon lamp, which, strangely enough, has also been in unusual demand during the past year, has fallen by the wayside through lack of manufacturing capacity.

In this connection, it is worthy of note that incandescent lamps and central-station lighting current are among the very few commodities that have not yet increased in selling price. Throughout the year utility lighting for the promotion of the war has been the keynote of the lighting business.

Lighting Researches for Government.

The efforts of the lighting industry have been directed toward the lighting problems of the Government and of the industries furnishing war supplies. We cannot emphasize too strongly the value of the

proper use of light in fighting the war. The applications extend from its use in revealing and concealing objects on the battle front and on the sea, step by step through every activity, including lighting of the railroads, docks and factories.

Realizing the importance of effective lighting, the Illuminating Engineering Society, promptly on the declaration of war, offered its services to the President

Efficient Installation of Industrial Lighting to Promote Intensified Production.

and various government officials and organizations. Well organized committees of the best known experts have for several months been freely giving patriotic service through a number of channels, many involving considerable research work. In this the Society has been singularly fortunate in helping to solve scientific and engineering lighting problems of immediate importance to the army and navy.

The "Lightless" Nights.

In the last few months the combined difficulties of the coal and railroad problems have seriously affected the lighting industry. Scarcity of fuel and delays in its shipment had already caused some curtailment of electric lighting in several cities when the United States Fuel Administrator issued his order of November 9 restricting many electric signs and other installations of display lighting to the hours 7:45 to 11 p. m. The fuel saving thereby effected was found to be comparatively small, so about a month later a new order was issued, cancelling the earlier one and substituting therefor what have come to be known as two "lightless" nights each week.

The curtailment of all outdoor lighting on these Sunday and Thursday nights is very marked indeed along prominent business streets in every enterprising city that has come to employ light liberally. It has effectively shown how much the lighting of signs, building fronts, store windows and ornamental standards contributes to the general street lighting. The only outdoor lighting permitted on the two nights in question is that needed for the public safety and for government purposes. Exactly what amount of lighting is required for safety is left to the individual interpretation of state fuel administrators, thus leaving the matter open to certain differences of opinion in different cities. Numerous exemptions are already being sought on the score of safety. Flat-rate lighting contracts affected by the order are being adjusted without much difficulty, as a rule.

The influence of the "lightless" nights order is being extended to light curtailment not specifically required. This is especially true of municipalities suffering from acute fuel shortage or scarcity of public funds, for both which reasons street lighting is being reduced in some cases by shortened schedules and others by cutting down the number of lamps. Railroad delays in shipments of lamps are also causing difficulties.

In connection with fuel saving in lighting it is interesting to note that many millions of carbon lamps are strangely still in use; if these were replaced by tungsten-filament lamps the increased efficiency of lighting could be taken advantage of to effect possibly as much, or more, coal saving as is being produced through the "lightless" nights.

What the coming year will bring forth, besides the intensified use of light in connection with definite war activities, is difficult to predict, but these activities will undoubtedly call for the utmost energy of illuminating engineers, lighting companies and manufacturers of lighting equipment.

NATIONALIZATION OF ELECTRIC POWER PRODUCTION SERIOUSLY PROPOSED IN GREAT BRITAIN.

Extraordinary Coal Economies Predicted if Government Takes Over of Electrical Supply—Sixteen Efficient Super-Power Stations Recommended for Entire Country.

A most radical solution of the related problems of electric power and coal supplies in Great Britain has been recommended in the report just submitted by the Coal Conservation Subcommittee of the commission studying the supply of electric power. The principal features of this revolutionary report are as follows:

Taking over by the government of the 600 odd electric power stations throughout the country, the owners being conpensated adequately. Nearly all these existing plants are small and inefficient in comparison with the large plants in many American cities and would therefore be superseded as soon as possible.

Construction at the most advantageous centers of about 16 gigantic generating stations supplying the entire country through high-tension interconnected networks. These highly efficient stations would permit shutting down of the numerous small plants mentioned above. In many cases these new stations would be located at the coal mines to minimize the wasteful transportation of coal. The transmission lines would in practically no case be over 100 miles in length.

Instead of burning the coal at these super-stations it is proposed to put in by-product coke plants, the gas being used to fire the steam boilers or used directly in gas-engine-driven generators, and the valuable by-products recovered by distillation, thus yielding an income from this source alone of $500,000,000 annually.

The entire project is to be undertaken and controlled by a national board of electricity commissioners representing the government.

The chairman of the subcommittee is Lord Haldane, who urges that the recommendations be carried out without delay as a measure of fuel economy primarily. It is estimated that at present about 80,000,000 tons of coal is used in Great Britain annually for the production of electric power. Of this amount the committee believes that 55,000,000 tons could be saved through the nationalization of power supply as recommended.

Lighting Progress for the Past Year

Development of Mazda Motion-Picture Lamp—Progress in Industrial and Street Lighting—Some New Lighting Units—A Convenient Foot-Candle Meter

By H. W. MATEER

DEVELOPMENTS in the lighting industry for the year 1917, as in other fields of endeavor, have been greatly influenced by the world war. The result of this influence has been most marked by the stimulation in some fields of lighting and, to some extent, the curtailment in other fields. Developments in the manufacture of Mazda lamps have been confined largely to the successful utilization of raw materials which have necessarily been substituted for those previously obtained from Europe. The result has been a gradual improvement in lamp quality.

Development of Motion-Picture Lamp.

However, there has been an original and notable achievement in the successful application of the incandescent lamp to motion-picture projection. The advent of the Mazda lamp for this purpose marks the first successful invasion of another lighting field previously dominated by the carbon arc. Two Mazda lamps have been developed for motion-picture projection. One has a capacity of 600 watts, operating at 20 amperes and 30 volts, and the other a capacity of 750 watts, operating at 30 amperes and 25 volts. The 20-ampere lamp is shown in Fig. 2. This lamp has a specially coiled filament of the monoplane type. The coils are in four segments equally spaced and in the same plane. The filament is inclosed in a type T-20 bulb and operates in an atmosphere of inert gas.

Parallel with the development of the Mazda motion-picture lamp has been that of the optical system with which it is used. This consists of a spherical mirror placed back of the lamp and a specially designed prismatic condensing lens in front. The mirror collects all of the light within a wide angle and directs a large part of it forward so that the images of the filament segments appear between the actual segments. The resulting effect is an approximate solid band of light as the source. The optical system is shown in Fig. 3.

At present the 20-ampere, 30-volt lamp is limited in its application to theaters having a projection throw up to 90 feet. It will successfully replace practically any alternating-current arc and also direct-current arcs up to approximately 35 amperes when fitted with the proper optical equipment.

The present list of Mazda C lamps for ordinary 110-125-volt multiple service includes the 150-watt size. This new size has been added in the last year to satisfy the demand for a lamp with a lumen output between the 100-watt and the 200-watt size.

Progress in Industrial Lighting.

The past year has seen notable progress in the field of industrial lighting. The demand for intensified industrial production has been greatly increased since our entrance into the war and naturally every effort

Fig. 1.—Night View of Euclid Avenue, Cleveland, Showing Street Lighting With Mazda Lantern System. The Streaks in the Street Are Caused by Automobile and Street-Car Headlights. The Picture Was Not Taken on a "Lightless" Night.

has been trained toward this end. The tendency toward the use of better illumination, that is, higher intensities and a better quality of light, is evidenced in several ways. The Industrial Commission of Ohio

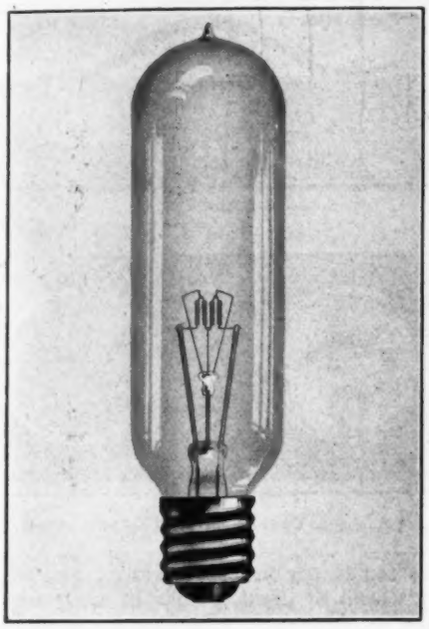


Fig. 2.—A 20-Ampere Mazda Lamp for Motion-Picture Projection.

has drawn up a lighting code in which much attention has been given to the proper light intensities for different operations. Methods of minimizing or preventing glare have also received much attention. The use of bowl-frosted Mazda C lamps with the dome-shaped steel reflector has been advocated as an improvement over the clear Mazda C lamps with open reflectors. Both direct and specular glare are minimized and illumination on vertical surfaces is superior to that with bowl reflectors.

With the idea of absolutely avoiding glare, a special unit* has been developed which makes use of a large porcelain-enameled steel reflector and a silvered cap placed over the bowl of the Mazda C lamp. The direct

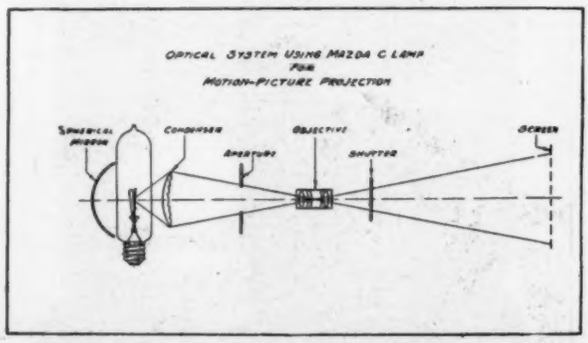


Fig. 3.—Optical System for Use With the Lamp Shown in Fig. 2.

rays from the filament are reflected by the silver cap to the large upper reflector whence they are diffusely reflected to the plane of illumination. This new and efficient unit is suitable for industrial work requiring a soft diffused light which must be obtained from direct lighting. Such an installation is shown in Fig. 4.

The fuel shortage and the recent orders of the United States Fuel Administrator have resulted in the discouragement of sign and display lighting for the period of the war. It is, however, worthy to note that flood lighting has come from the strictly esthetic to a utilitarian use—that of protective lighting. The past year has seen a great stimulation in this comparatively new field. Flood-lighting projectors, searchlights, and open steel reflectors have been used to a great extent for lighting the exterior of industrial plants, docks, bridges, railway yards, etc. Fig. 5 shows the use of angle reflectors for protective lighting.

Developments in Street Lighting.

In the field of street lighting the incandescent lamp has continued to replace the carbon arc. There has been one street-lighting unit developed which is especially worthy of note in that it embodies the good features of previous designs in addition to improvements over the undesirable features. Several years ago the prismatic refractor came into extended use as a means of increasing the candlepower of street-lighting units in the horizontal zone. Various units were designed with the prismatic refractor around the lamp and the whole inclosed in either a clear-glass or opal-glass

Fig. 4.—Machine Shop Employing Reflecto-Cap Diffusing Units.

globe. In some cases no inclosing globe was used. With no inclosing globe, the brilliancy of the light source made such units objectionable for some locations. The use of the opal inclosing globe resulted in a diffusion of the light and served to reduce depreciation due to dirt collection, but the diffusing properties of the opal glass tended to interfere with direction of the light flux emitted near the horizontal, making the distribution from the unit less intense near the horizontal and more intense at angles near the vertical. A unit recently developed, and shown in Fig. 6, makes use of a two-piece prismatic dome refractor and an inclosing globe of stippled glass. The new features of the refractor are that no diffusing prisms are employed, but both sets of prisms are used to bend the light rays through large angles. The inclosing globe is pressed in one piece with a stippled finish on the inside. The surface has no sharp edges nor crevices, but its unevenness is sufficient to obscure the lamp filament and to modify the brilliancy of light from the refractor without materially altering the general direction of the light rays.

*Electrical Review and Western Electrician, June 9, 1917, page 988.

One of the most interesting achievements in connection with lighting has been the development of the foot-candle meter. This is a device for measuring light intensities used in ordinary artificial lighting.

Fig. 5.—Angle Reflector Units Used for Protective Lighting.

While the instrument is not as accurate as many other portable photometers, its simplicity of operation, its compactness, together with its fair degree of accuracy cause it to fulfill a long felt need.

A New Foot-Candle Meter.

The foot-candle meter is shown in Figs. 7 and 8. Its operation is based on the photometric principle of comparing a known intensity with an unknown. It has a white comparison screen which consists of a piece of clear glass on which are two thicknesses of paper; one contains round holes and is opaque, and the other is translucent. The screen is illuminated to a graded intensity from the under side by a miniature lamp operating at voltage fixed by the dry battery and small rheostat which forms part of the equipment. When the lamp is lighted, the round spots appear in graduated brightnesses. In operation, the voltage on

Fig. 6.—A New Street-Lighting Unit Using Prismatic Dome and Stippled-Glass Outer Globe.

the miniature lamp is regulated by the rheostat, the small voltmeter indicating the correct value. When the instrument is placed in the location where the intensity is to be measured, the actual determination requires that the operator pick out the spot on the screen which appears to be of the same brightness as the background. From the graduated scale beneath the spots,

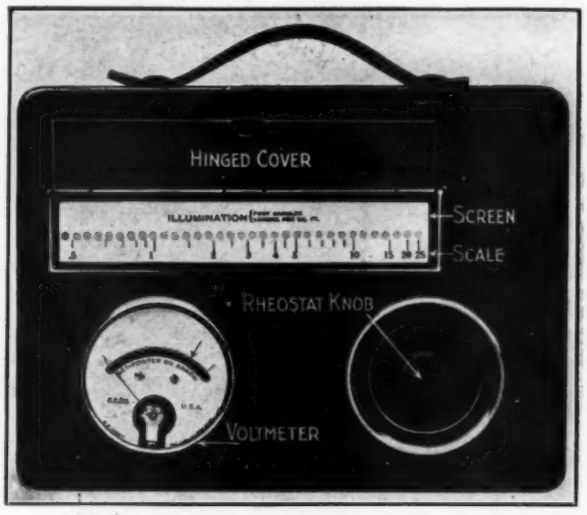


Fig. 7.—A Convenient Foot-Candle Meter.

the foot-candles can be read directly. The foot-candle meter has been of great service in analyzing lighting conditions as they exist. Because of its simplicity of operation, it may be used by the layman as well as the illuminating engineer. It is to be expected that with its extended use, illumination data will be of comprehensive value, not only to the expert, but to every one concerned.

Lighting developments for the past year tend to indicate the trend for the coming year. If the war continues, it is probable that there will be a continued stimulation of protective and industrial lighting and an opposite effect on display and sign lighting. In other words, all lighting which is not essential to the carrying on of the war will in all probability be more or

Fig. 8.—Foot-Candle Meter Opened to Show Essential Parts.

less discouraged as a measure of fuel conservation and the tendency will be to use the most efficient sources for that lighting which is necessary.

ELECTRIC AND GAS UTILITIES IN 1917 AND 1918.

In Spite of Higher Operating Costs Many Companies Show Gain in Net Revenues—Features of the Year's Development.

By W. H. Hodge.

The features sharply defined in the electric light and power and gas industries during 1917 are:

(1) The highly essential nature of these industries under war conditions as well as during peaceful times.

(2) Extraordinary demands for additional service by munitions plants, mines, shipyards, refineries, cereal mills, packing plants and establishments producing other necessities.

(3) Increased operating expenses, due to unprecedented prices for coal, labor and supplies.

(4) Inauguration of a period of higher service rates to meet increasing expenses, and destruction of the fallacy that public utility rates cannot be readily advanced to conform with changed conditions.

(5) Creation of new sources of investment capital despite unusual difficulties in financing extensions and improvements.

(6) The imperative need for immediate water-power development on the widest practicable scale.

Each successive month of the war brings into clearer relief the economic functions performed by the electric and gas companies in the saving of time, of labor, of fuel and of capital. With more than one-half of the industrial power of the country already supplied by these organizations, they are being called upon in increasing measure for effort of the most vital kind.

The central stations burn only about 50 per cent of the coal required for individual power plants. Electric motors are among the greatest aids to speed and the saving of man power in any factory or shop. The factory that buys energy does not have to invest capital in its own power plant. Gas replaces coal and oil at a saving in many industrial operations. Its by-products are used in explosives.

These are some of the reasons why the electric and gas industries performed at least 25 per cent greater service than in any preceding year and why they must continue to expand as an indispensable factor in national efficiency.

Unheard of prices for coal, copper, steel and all supplies and materals, and the highest wages ever paid in the United States bore down heavily on the electric and gas companies during the year. The fact that many of them emerged with respectable gains in net earnings testifies to their ability to effect economies and develop new standards of efficiency.

Few electric companies depend solely on water power for production. The great majority of water powers must be reinforced with steam-power reserves and it usually is the steam reserve that carries abnormal or suddenly developed business. Therefore, practically all power companies, along with the gas companies, have had to buy coal at prices which no one imagined would ever prevail when the rates charged for service were fixed.

For the first time in their history these two service industries have been compelled to seek higher rate schedules. Heretofore rates have been reduced so steadily and persistently that the possibility of a movement upwards was unthought of. Courageously presenting their cases to public service commissions, city officials and the public utility organizations secured not far from 500 rate advances in 1917. Relatively few applications of this kind have been rejected, and an unexpected attitude of friendly co-operation on the part of the public and its representatives has been developed. The probabilities are that many additional rate increases will become effective in 1918.

Called upon for an extraordinary volume of service in 1917, the utilities were faced with difficulties in financing. Fortunately the increased business of the preceding two years had made necessary large additions to producing and distributing equipment. Many of these improvements had been installed, or were in process of installation and much of the financing had been accomplished. Utility obligations maturing in 1917 were comparatively small. Notwithstanding this situation there remained considerable financing to be done during the year.

Since the initial war financing in June scarcely any money has been raised for the utilities in the investment centers except by the sale of short-term notes at a high interest rate, and the highest grade bonds on a 6 per cent basis. Confronted with this situation an increasing number of companies began the development of supplementary financial sources in the cities and towns to which they rendered service. At Minneapolis, St. Paul, Denver, Pueblo, Los Angeles, San Diego, Salt Lake City, Omaha, St. Louis, Oklahoma City, Baltimore, San Francisco, and many smaller places, corporations offered their stock to the public with a most gratifying response. Millions of dollars were thus secured for important extensions on terms fair both to the companies and the investors.

Pioneers in this movement in 1915 were the Northern States Power Company and other companies managed by H. M. Byllesby & Company, the Pacific Gas & Electric Company and the Baltimore Consolidated Gas, Electric Light & Power Company. Up to the summer of 1917 the Byllesby interests had confined the plan to the Northern States Power Company and the San Diego Consolidated Gas & Electric Company, but in the latter part of the year they extended its operation to more than two-thirds of their properties, with the result that recent financing at Byllesby properties has aggregated not less than $2,500,000.

Not only have the utilities created a new investment field for their customers and a new source of supplementary financing for themselves, but they have established a new kind of protection against political assaults of unquestioned value to the general investor in utility securities.

Following the national policies defined at Washington utility companies are restricting construction and capital investment to the closest limits. Only those additions and extensions absolutely necessary to public and industry are countenanced. Business responding to this definition, however, will probably continue to force itself upon the utilities in 1918.

The tests surmounted by the utilities in 1917 and their ability to obtain compensatory rates indicate their power to maintain the virile stability for which they have been noteworthy.

New York Electrical Society Holds Big Meeting.—The 360th meeting of the New York Electrical Society was held on December 20. The scheduled program included a paper by Frank M. Leavitt, inventor of the Bliss-Leavitt torpedo, entitled "A Brief Historical Sketch of the Development of the Torpedo"; also an address by W. A. LaDue of the Public Service Electric Company of New Jersey upon "Aerial Cable Construction," illustrated with motion pictures.

Conditions in Electrical Manufacturing During 1917

A Concise Statement of the Effect of the Unprecedented Demands on Manufacturing Facilities and the Tendency for This Year—Statistical Table of Electrical Products

By CHARLES H. ROTH

Secretary, Electric Power Club.

A REVIEW of conditions during the past year as affecting the manufacturers of electric power apparatus will show that it has been a strenuous period with them.

Most manufacturers found a decided upward change in demand in the fall of 1915, and this upward tendency has prevailed ever since. Extensive enlargement of plant capacity by some manufacturers with the consequent easing up of tension on their equipment gives the impression to some of a lessening activity at the present time. In reality it is a more rapidly increasing supply than of increasing demand. Unless due caution is used in such enlargement of equipment there is liable to be a serious surplus of supply in the future with consequent demoralization of prices.

Buyers of electrical apparatus should learn to anticipate their requirements and not expect to secure delivery, especially of special apparatus, from stock.

Charles H. Roth.

There is a slight falling off in demand for some lines of apparatus that go to non-essential business, but the ever-increasing demand of the various departments of the Government, due to war activities, is causing enlargement of many manufacturing plants in essential industries, resulting in the purchase of much new power apparatus. The demand for motors of over 25 horsepower is good and above 100 horsepower is not at all satisfied by the present output.

At various times during the year there have been indications of shortage of necessary raw or semi-finished materials and while the supply of materials is not up to immediate demand, manufacturers have learned that they must anticipate their requirements and have been forced to carry much larger stocks than in former years and in this way they have been able to take care of their orders, in some cases with considerably deferred shipping dates.

Prices of apparatus have not kept pace with the increase in cost of material and labor, with a consequently narrower margin of profit to the manufacturer. The latter part of the year has, however, shown a much steadier condition in prices of materials, undoubtedly due to the fixing of prices of raw materials by the Government.

The power apparatus manufacturers, through a War Industries Committee composed of the Board of Governors of the Electric Power Club, are co-operating with the Government in securing the quickest delivery and the maximum output of apparatus required by the various Government departments.

Officials of the Electric Power Club in consultation with Government officials assisted the Government in securing the services of a number of well-posted power apparatus men. These, with Mr. Walter Robbins as the head, form the electrical division of the War Industries Board of the Council of National Defense.

This electrical division is gathering data from all manufacturers as to stock on hand, orders on their books, both Government and regular orders, delivery promises and possible output, all for the purpose of assisting the various departments of the Government, its allies and essential manufacturing industries in securing a prompt supply of their requirements in power apparatus, and also to so apportion the business that each manufacturer will be able to operate his plant at its best efficiency.

Similar surveys are also being made by other branches of electrical manufacturing so as to give the most complete and up-to-date information on the manufacturing facilities available for the Government's immediate needs. A fine spirit of co-operation has been developed among the different electrical manufacturing interests in meeting the country's needs promptly and adequately. In spite of numerous losses of skilled employees, who have ben enrolled in active war service, every possible effort has been made to increase efficiencies of production and enlarge producing facilities so that the nation's war activities may not be hampered.

Estimated Value of Materials Used in the Electrical Industry in 1917

In presenting the accompanying estimate every effort has been made to achieve the maximum degree of accuracy. While the figures are offered only as estimated values, there are some actual figures included in the list. This is particularly true in the fields where the production is controlled by comparatively few manufacturers.

It may be of interest to state briefly the manner in which the estimates were compiled. Inquiries were directed to practically every electrical manufacturer asking for the actual value of his products, manufactured during 1917. Each manufacturer was also asked to estimate the value of the business done by all manufacturers in their field, based on their own production. Where complete returns were received the actual value was computed. Where it was not possible to obtain complete returns in any one field, the returns received were checked against the average of the estimates for that field.

This opportunity is taken to thank those manufacturers who so kindly co-operated in this work and also the various electrical trade organizations who gave valuable assistance.

ARTICLE.	VALUE.
Air Washers, cooling ponds, etc.	$ 210,000
Arc lamps and appurenances	700,000
Auxiliaries, steam, for electrical installations, such as pumps, condensers, separators, feed-water heaters, injectors, piping, etc.	7,575,000
Brackets, pole-line hardware, etc.	6,250,000
Bells, buzzers, push-buttons, call-boxes, annunciators	1,750,000
Boilers for electrical plants (water-tube)	3,500,000
Boilers for electrical plants (other than water-tube)	2,000,000
Cables, underground, aerial and submarine	17,400,000
Carbons for lamps, batteries, brushes or other electrical purposes	10,000,000
Circuit-breakers	2,350,000
Conduits (underground) and similar material	950,000
Electroplating and other electrolytic apparatus not elsewhere specified	2,000,000
Electrostatic machines, induction coils, medical sets	750,000
Elevators, electric (mechanism only)	4,500,000
Engines, gas or gasoline or oil, used to drive electrical machinery	9,000,000
Engines, steam (reciprocating), used to drive electrical machinery	4,500,000
Fans, electrically operated and direct-connected	4,700,000
Fire-alarm apparatus, also burglar alarms, crossing indicators, etc.	1,000,000
Fixtures for electric lighting	18,300,000
Fuses	3,500,000
Generators	75,475,000
Glassware, electrical	6,000,000
Heating and cooking apparatus, electrical	6,200,000
Incandescent lamps (carbon or metal filaments)	52,000,000
Instruments for measurement and meters, of all kinds; also ground detectors, scientific and laboratory apparatus, photometers, Leyden jars, X-ray outfits, etc.	8,500,000
Insulating material, fiber, tape, etc.	7,550,000
Insulators (glass and porcelain)	4,000,000
Interior wiring supplies, as tubing, interior conduit, molding, junction boxes, rosettes, outlet boxes, etc.	10,575,000
Lightning arresters	800,000
Mercury-vapor lamps	1,100,000
Motors, including parts of machines, boosters, balancers, rotary converters, motor-generators, etc., and all motor applications, such as in automobiles	95,470,000
Poles and wire towers, crossarms, etc.	5,100,000
Primary batteries	6,000,000
Railway supplies, electric, such as trolleys and other contact devices, strain insulators, cross-overs, rail-bonds, etc.	7,300,000
Rheostats, car controllers, motor starters, etc.	7,000,000
Shafting, pulleys, clutches, etc., used in electrical generating plants	1,500,000
Signs, electric	3,475,000
Sockets, switches, cut-outs	9,360,000
Steam turbines, used to drive electrical machinery	19,200,000
Storage batteries, including used in automobiles	16,000,000
Telegraph instruments and apparatus	1,000,000
Telephones, telephone switchboards and distinctively telephonic apparatus	27,000,000
Transformers, stationary	26,000,000
Water-wheels, used to drive electrical machinery	4,100,000
Welding apparatus, electric	460,000
Wire, rubber-covered	68,600,000
Wire, weatherproof	12,000,000
Wire, all other electrical	15,000,000
Wireless apparatus	3,100,000

Central-Station Rate Increases During 1917

An Authentic Compilation of Increses in Rates for Electricity Which Have Been Made Necessary by Increased Operating Costs

ABNORMAL increases in the cost of fuel, labor and equipment, combined with unprecedented demands for service, have made it necessary for many central-station companies to increase rates for electricity during the past year. The increase in coal cost, in some instances as much as 300 per cent and over, has been most responsible, and doubtless when existing fuel contracts expire and new prices are demanded, many more companies will find that their only recourse is increased rates.

The record of the central-station industry in the matter of rates is an enviable one and has no parallel in our commercial activity. During the past few years the prices of all commodities have steadily increased and although the cost of labor and of all materials and equipment entering into the manufacture and supply of electricity has made noticeable advances, the cost of electricity has been continuously and consistently reduced.

Ever since our entrance into the world war every effort has and is still being made to effect greater operating economies so that it would not be necessary to increase rates. However, many central-station companies have been operating on such small margins that even a slight increase in the cost of coal would mean additional operating expense that must be counteracted by new business, so it can readily be seen that in the face of present coal prices, increased rates are the only recourse.

From the foregoing it should not be construed that there has been a general advance in rates by the central-station industry. As a matter of record, considerably less than 10 per cent of the companies operating steam plants have made increases. In most cases the increase in rates is only temporary and is contingent on coal prices and in very few instances have residential rates been advanced, the increase affecting power users only. The so-called "coal clause" which permits a company to vary its rates in accordance with the price of coal has been adopted in many instances and is proving a very satisfactory means for protecting the company against future advances in fuel cost.

In order to present an authentic record of the increases in rates that have been made since January 1, 1917, the ELECTRICAL REVIEW directed an inquiry to every state public service commission asking for the names of the companies making an increase and the amount thereof. In a number of states the law provides that changes in rates may be made by publishing, filing and posting of the changes, giving 30 days' notice to the public and the commission, when the changed rates thus become effective automatically on the date fixed. There have been comparatively few rate increases made in the states having such laws which include Pennsylvania, Connecticut, Iowa and Minnesota.

Among the states where permission must first be secured from the commission before an increase can be made are several where no companies have asked such permission. In the following states no central-station companies have asked for permission to increase rates: Wyoming, Oklahoma, Arizona, Idaho, Vermont, Nevada, Georgia, North Carolina, Maine and New York.

The following compilation gives some of the increases in the rates of electric companies which have been made during the year 1917, most of them during the last six months. The data presented give an idea of the classes of service usually bearing the increase and the methods used by the different companies in making increases. Coal clauses are added in many cases to the power rates; in a number of cases the rates for the larger blocks are increased; and a few cases are included where the entire rate has been changed in such a way as to make it rather difficult to judge of the result of the revision.

Alabama.

MOBILE ELECTRIC COMPANY, MOBILE, ALA.

The following coal clause was added to all power rates:

The rate increases 0.1 cent net per kilowatt-hour for each 50 cents or fraction thereof increase in f. o. b. price of coal above $2.00 per ton.

California.

CALISTOGA ELECTRIC COMPANY, CALISTOGA, NAPA COUNTY, CAL.

This company has been granted an increase of 10 per cent on its annual income from its 314 customers, representing an annual gross revenue of about $1,005.

Colorado.

COLORADO SPRINGS LIGHT, HEAT AND POWER COMPANY, COLORADO SPRINGS, COLO.

The energy charge of the large light and power service rates was increased from .9 cent to 1 cent per kilowatt-hour for alternating current and from 1.1 cent to 1.2 cent per kilowatt-hour for direct current.

The energy charge of the mill-power rate was increased from 5 cents to 6 cents per kilowatt-hour.

The rate to reduction mills was increased from .95 cent to 1 cent per kilowatt-hour.

The rate for large hotels—light and power—was increased from 2.1 cents to 2.6 cents per kilowatt-hour for the first 4,500 kilowatt-hours and from 1.75 cents to 2 cents per kilowatt-hour for the excess. Sign and display lighting rate was also increased. These rates were prescribed by the Colorado Public Utilities Commission. The total increase authorized is in the neighborhood of $25,000 annually.

SUBURBAN LIGHT & POWER COMPANY, AURORA, COLO.

The company increased its rates and charges for commercial and domestic lighting to an amount of about $500 per year.

Connecticut.

THE HARTFORD ELECTRIC LIGHT COMPANY, HARTFORD, CONN.

A one-half cent increase per kilowatt-hour for residence lighting, commercial lighting and heating and cooking service; increase in general power rates; and the following coal clause added to optional power service:

"The energy charge of 0.7 cent per kilowatt-hour is based upon a coal price of $3.75 per ton and is subject at any time to an automatic increase at the rate of 0.15 cent per kilowatt-hour for each increase of $1.00 per ton in the price which may be paid for coal above $3.75."

THE CONNECTICUT LIGHT AND POWER COMPANY, NEW BRITAIN, CONN.

Former rate for retail power service provided 1.8 cent for all excess use over 30,000 kilowatt-hours consumed per month. This rate is discontinued and the rate of 2.1 cents is charged for all excess use over 25,000 kilowatt-hours consumed per month.

The general power rate has been changed. The former rate was as follows:

Demand charge:
$6.00 for the first kilowatt of demand.
$4.50 per kilowatt for the next 2 kilowatts.
$3.00 per kilowatt for the next 2 kilowatts.
$2.00 per kilowatt for the next 10 kilowatts.
$1.75 per kilowatt for the next 35 kilowatts.
$1.25 per kilowatt for the next 450 kilowatts.
$1.20 per kilowatt for the next 500 kilowatts.
$1.10 per kilowatt for all excess, plus an
Energy charge of
3 cents per kilowatt-hr. for the first 150 kilowatt-hrs.
2 cents per kilowatt-hr. for the next 150 kilowatt-hrs.
1.75 cents per kilowatt-hr. for the next 200 kilowatt-hrs.
1.65 cents per kilowatt-hr. for the next 500 kilowatt-hrs.
1.1 cents per kilowatt-hr. for the next 9000 kilowatt-hrs.
0.9 cent per kilowatt-hr. for the next 10,000 kilowatt-hrs.
0.75 cent per kilowatt-hr. for the next 10,000 kilowatt-hrs.
0.7 cent per kilowatt-hr. for all excess.

The new rates are:

Demand charge:
$2.60 per kilowatt for the first 5 kilowatts of demand.
$2.10 per kilowatt for the next 10 kilowatts of demand.
$1.60 per kilowatt for the next 35 kilowatts of demand.
$1.00 per kilowatt for the next 250 kilowatts of demand.
.80 per kilowatt for excess use, plus an
Energy charge of
3.1 cents per kilowatt-hr. for the first 500 kilowatt-hrs.
1.8 cents per kilowatt-hr. for the next 1000 kilowatt-hrs.
1.05 cents per kilowatt-hr. for the next 8500 kilowatt-hrs.
0.85 cent per kilowatt-hr. for the next 40,000 kilowatt-hrs.
0.6 cent per kilowatt-hr. for excess use.

The following coal clause has been added to the schedules for retail power and general power:

"The rates increase or decrease 0.001 cent per kilowatt-hour for each 1 cent increase over $4.50, or decrease below $3.80 in average price per long ton of coal delivered, of equivalent heating value of 13,500 B. t. u. per pound, during the three months preceding the month for which bill is rendered."

THE CONNECTICUT LIGHT AND POWER COMPANY, WATERBURY, CONN.

The former rates for retail power were:

8 cents per kilowatt-hour for the first 50 kilowatt-hours.
7 cents per kilowatt-hour for the next 50 kilowatt-hours.
6 cents per kilowatt-hour for the next 50 kilowatt-hours.
5 cents per kilowatt-hour for the next 150 kilowatt-hours.
4 cents per kilowatt-hour for the next 300 kilowatt-hours.
3.5 cents per kilowatt-hour for the next 400 kilowatt-hours.
2.1 cents per kilowatt-hour for the next 19,000 kilowatt-hours.
1.6 cents per kilowatt-hour for the next 80,000 kilowatt-hours.
1.6 cents for entire consumption when 100,000 kilowatt-hours or over.
1.5 cents for entire consumption when 150,000 kilowatt-hours or over.

The rates for the first blocks of the new rate remain the same down to 2.1 cent rate and that rate applies to all excess over 1000 kilowatt-hours consumed.

The same changes were made in the general power rate for Waterbury as were made for New Britain. (See above.)

The coal clause in effect in New Britain is also applicable to the retail power and general power rates for Waterbury.

Indiana.

INDIANAPOLIS LIGHT AND HEAT COMPANY, INDIANAPOLIS, IND.

The Company has been granted authority by the Indiana Public Service Commission to add a surcharge of 0.5 cent per kilowatt-hour to bills for electric service rendered between September 1, 1917, and June 30, 1918.

MUNCIE ELECTRIC LIGHT COMPANY, MUNCIE, IND.

The Indiana Commission authorized the Company to add to power bills in the cities of Muncie, Normal City, Riverside City, Shideler, Eaton, Hartford City, Dunkirk and Redkey a flat arbitrary ten per cent surcharge on July 1, 1917, the same to run until January 1, 1918, or until such time as revoked or revised by the Commission. (1,1 Rate Research 248.)

MERCHANTS HEAT & LIGHT COMPANY, INDIANAPOLIS, IND.

Authorized to add surcharge of 5 mills per kilowatt-hour on all bills except the 7 cent residence rate.

ROCKPORT WATER WORKS COMPANY, ROCKPORT, IND.

Authorized to increase rates from 7½ to 8 cents on the second 25 k. w. h. consumed in accordance with the franchise; and also increase of rates on power of 10 per cent on the first 50 k. w. h. consumed to 40 per cent on the fifth 50 k. w. h. consumed and to any excess of the 50 k. w. h.

Kentucky.

CARLISLE ELECTRIC LIGHT & POWER COMPANY, CARLISLE, KY.

This company of 5 cents on the kilowatt-hour charge has been allowed by the City Council. The agreement contains a clause enabling the Council to terminate the increase on a month's notice.

Maryland.

CONSOLIDATED GAS, ELECTRIC LIGHT & POWER COMPANY, BALTIMORE, MD.

The following coal clause was added to the primary industrial power rate, the flat rate for primary industrial power and the railway generating power rate:

The energy charge for current supplied over 2300 volts is increased or decreased 0.033 cent per kilowatt-hour for each 10 per cent increase above or decrease below $2.70 in price per ton for coal delivered during the month for which bill is rendered.

Massachusetts.

THE EDISON ELECTRIC ILLUMINATING COMPANY, BOSTON, MASS.

The following coal clause was added to the company's rates for large lighting and power service, large power service, and theater service:

"Whenever during any month in which electricity is furnished under this agreement the cost at its stations of a sufficient amount of coal used by the company to do the work of a long ton of coal under the conditions prevailing during the calendar year 1916, and according to the provisions of its contract then in force, applying the specifications therein to all kinds of coal, exceeds the cost of such long ton at its stations during the year 1916, then for each and every one cent of such excess cost a charge will be made, in addition to the prices named in this agreement, of 1¼ cents per thousand kilowatt-hours for all kilowatt-hours sold under this agreement."

THE EDISON ELECTRIC ILLUMINATING COMPANY, BROCKTON, MASS.

The company issued a coal clause to be added to its power contracts.

"If the cost to the Company of coal of Pocahontas, New River or equivalent quality exceeds $5.00 per long ton for a period exceeding 3 consecutive months, the rate for electric energy increases 0.006 cents per kilowatt-hour for each 5 cent increase in cost over and above $5.00 per gross ton. If such average price of coal is less than $4.25 per long ton, then the Company will in corresponding manner reduce its price 0.006 cent per kilowatt hour."

FALL RIVER ELECTRIC LIGHT COMPANY, FALL RIVER, MASS.

The coal clause added to the company's general power schedules and to its primary service rate increases the rates one mill per kilowatt-hour for every dollar increase in the cost of coal above $4.00 per ton and decreases the rates one mill per kilowatt-hour for every dollar decrease below $3.50 per gross ton.

The rates for primary service were:

1.5 cents per kilowatt-hour for the first 50,000 kilowatt-hours.
1 cent per kilowatt-hour for the next 100,000 kilowatt-hours.
0.9 cent per kilowatt-hour for all excess.

The present rate reads:

1.5 cents per kilowatt-hour for the first 50,000 kilowatt-hours.
1 cent per kilowatt-hour for all excess use.

FITCHBURG GAS AND ELECTRIC COMPANY, FITCHBURG, MASS.

The rates for general power service have been increased 6 mills per kilowatt-hour.

LOWELL ELECTRIC LIGHT CORPORATION, LOWELL, MASS.

A coal clause has been added to the industrial power rate and the large industrial power rate.

MALDEN ELECTRIC COMPANY, MALDEN, MASS.

The energy charge in the rates for general power was increased ½ cent per kilowatt-hour.

ADAMS GAS LIGHT COMPANY, ADAMS, MASS.

Increase of ½ cent a kilowatt-hour.

BEVERLY GAS AND ELECTRIC COMPANY, BEVERLY, MASS.

Increase of 1 cent a kilowatt-hour.

NEWBURYPORT GAS AND ELECTRIC COMPANY, NEWBURYPORT, MASS.

Increase of ½ cent per kilowatt-hour for power.

NORTH ADAMS GAS LIGHT COMPANY, NORTH ADAMS, MASS.

Increase of ½ cent per kilowatt-hour for power.

PITTSFIELD ELECTRIC COMPANY, PITTSFIELD, MASS.

Rates for electric power are subject to change at the rates of 1¼ mills per $1.00 increase or decrease in cost of coal delivered on cars in Pittsfield above and below $7.50 per ton.

QUINCY ELECTRIC LIGHT AND POWER COMPANY, QUINCY, MASS.

Graduated increase to customers using more than 50 kilowatt-hours for power.

SALEM ELECTRIC LIGHTING COMPANY, SALEM, MASS.

Increase of ½ cent per kilowatt-hour for power.

NEW BEDFORD GAS AND EDISON LIGHT COMPANY, NEW BEDFORD, MASS.

General power rate and the long-hour general power rate have been increased by 2½ mills per kilowatt-hour.

SUBURBAN ELECTRIC LIGHTING COMPANY, REVERE, MASS.

Increase of ½ cent per kilowatt-hour for power.

CHICOPEE MUNICIPAL PLANT, CHICOPEE, MASS.

Increase of 20 per cent on all power rates.

DANVERS MUNICIPAL PLANT, DANVERS, MASS.

Increase of 1 cent per kilowatt-hour on lighting rates. Increase of ½ cent per kilowatt-hour on power rates.

PEABODY MUNICIPAL PLANT, PEABODY, MASS.

Increase of ½ cent per kilowatt-hour on power rates.

Michigan.

CONSUMERS POWER COMPANY, FLINT, MICH.

Its rate for general power was increased from 4.44 cents per kilowatt-hour for the first 60 hours' use of demand and 3½ cents per kilowatt-hour for all excess, to 5 cents per kilowatt hour for the first 60 hours' use of demand and 3.89 cents per kilowatt-hour for all excess.

The demand charge in the schedule for optional power was:

$1.67 per horsepower for the first 5 horsepower of demand.
$1.50 per horsepower for the next 10 horsepower of demand.
$1.33 per horsepower for the next 10 horsepower of demand.
$1.17 per horsepower for the next 25 horsepower of demand.
$1.00 per horsepower for excess.

The demand charge now in effect is:

$1.67 per horsepower of demand.

The rate for primary power was increased. The former rate was as follows:

Demand Charge:
$30.00 per year per kilowatt for the first 50 kilowatts of demand.
$20.00 per year per kilowatt for the next 50 kilowatts of demand.
$15.00 per year per kilowatt for the next 400 kilowatts of demand.
$12.00 per year per kilowatt for excess, plus an
Energy Charge of
0.7 cent per kilowatt-hour for the first 250 hours' use of demand.
0.5 cent per kilowatt-hour for all excess.
Prompt Payment Discount: 5 per cent, 23 days.

The new rates are:

Demand Charge:
$30.00 per year per kilowatt for the first 50 kilowatts of demand.
$20.00 per year per kilowatt for the next 50 kilowatts of demand.
$15.00 per year per kilowatt for excess, plus an
Energy Charge of
0.95 cent per kilowatt-hour for the first 250 hours' use of demand.
0.75 cent per kilowatt-hour for excess.
Prompt Payment Discount: 2 per cent, 23 days.

CONSUMERS POWER COMPANY, GRAND RAPIDS, MICH.

The demand charge for lighting and power service was changed. The former rate was:

$24.00 per kilowatt for the first 50 kilowatts of active load.
$18.00 per kilowatt for the next 50 kilowatts of active load.
$15.00 per kilowatt for excess.

The rate now in effect is:

$24.00 per kilowatt for the first 50 kilowatts of demand.
$18.00 per kilowatt for excess.

The energy charges in this rate for lighting and power service were increased 0.5 cent per kilowatt-hour.

The primary power rate was changed same as in Flint, Mich.

CONSUMERS POWER COMPANY, KALAMAZOO, MICH.

The energy charge of the rate for optional commercial lighting was increased from

3.33 cents to 3.89 cents per kilowatt-hour for the first 30 hours' use of active demand.
2.77 cents to 3.33 cents per kilowatt-hour for the next 60 hours' use of active demand.
2.22 cents to 2.78 cents per kilowatt-hour for all excess.

The energy charge of the optional rate for power service was increased from 1.11 cents to 1.67 cents per kilowatt-hour.

The energy charge of another optional power rate was increased from

3.33 cents to 3.89 cents per kilowatt-hour for the first 30 hours' use of demand.
2.22 cents to 2.78 cents per kilowatt-hour for the next 90 hours' use of demand.
2 cents to 2.5 cents per kilowatt-hour for excess.

The rate for primary power was changed the same as in Flint and Grand Rapids, Mich.

MICHIGAN POWER COMPANY, LANSING, MICH.

The former rates for general lighting and power were:

5 cents per kilowatt-hour for the first 50 kilowatt-hours.
4 cents per kilowatt-hour for the next 100 kilowatt-hours.
3 cents per kilowatt-hour for the next 850 kilowatt-hours.
2 cents per kilowatt-hour for the next 4000 kilowatt-hours.
1.75 cents per kilowatt-hour for the next 5000 kilowatt-hours.
1.4 cents per kilowatt-hour for the next 35,000 kilowatt-hours.
1.25 cents per kilowatt-hour for excess.
Minimu Charge: 50 cents gross, 40 cents net, per meter.

The present rates in effect are:

5 cents per kilowatt-hour for the first 50 kilowatt-hours.
4 cents per kilowatt-hour for the next 100 kilowatt-hours.
3 cents per kilowatt-hour for the next 850 kilowatt-hours.
2 cents per kilowatt-hour for the next 4000 kilowatt-hours.
1.75 cents per kilowatt-hour for excess.
Minimum Charge: 50 cents net.

The straight line meter rate for wholesale lighting and power was increased from 0.85 cent to 0.95 cent per kilowatt-hour and later was increased to 1.25 cents per kilowatt-hour. The minimum charge of this rate was increased from $915.42 net to $2,500 net.

The energy charge for auxiliary power was increased from 1.1 cents per kilowatt-hour to 1.4 cents per kilowatt-hour.

The suburban lighting rate was changed by increasing the last step from 5 to 6 cents per kilowatt-hour for excess consumption (over 30 hours' use of demand), and the minimum charge from 50 to 65 cents per meter.

The suburban lighting and power rates were:

10 cents per kilowatt-hour for the first 30 hours' use of demand.
7 cents per kilowatt-hour for the next 30 hours' use of demand.
4 cents per kilowatt-hour for excess.

In the present rates in effect the second block is increased 1 cent and the minimum charge increased from 50 to 65 cents per meter.

The suburban retail power rate was formerly:

4 cents per kilowatt-hour for the first 60 hours' use of demand.
3 cents per kilowatt-hour for the next 60 hours' use of demand.
2 cents per kilowatt-hour for the next 180 hours' use of demand.
1 cent per kilowatt-hour for excess use.
Minimum Charge: 50 cents per meter.

The present rate in effect is:

5 cents per kilowatt-hour for the first 60 hours' use of demand.
4 cents per kilowatt-hour for the next 60 hours' use of demand.
2.5 cents per kilowatt-hour for excess use.
Minimum Charge: 65 cents per meter.

CONSUMERS POWER COMPANY, SAGINAW, MICH.

The primary power rate was increased. The former rate was:

Demand Charge:
$30.00 per year per kilowatt for the first 50 kilowatts of demand.
$20.00 per year per kilowatt for the next 50 kilowatts of demand.
$15.00 per year per kilowatt for the next 400 kilowatts of demand.
$12.00 per year per kilowatt for excess, plus an
Energy Charge of
0.7 cent per kilowatt-hour for the first 250 hours' use of demand.
0.5 cent per kilowatt-hour for excess.

The new rate is:

Demand Charge:
$30.00 per year per kilowatt for the first 100 kilowatts of demand.
$27.00 per year per kilowatt for the next 100 kilowatts of demand.
$23.00 per year per kilowatt for excess, plus an
Energy Charge of
0.7 cent per kilowatt-hour.

Minnesota.

NORTHERN STATES POWER COMPANY, FARIBAULT, MINN.

The company has announced a 10 per cent war emergency surcharge to electric light, power and gas bills of the Faribault division, effective January 1, 1918.

MINNEAPOLIS GENERAL ELECTRIC COMPANY, MINNEAPOLIS, MINN.

A temporary surcharge of 10 per cent will be added to power bills and 5 per cent to lighting bills after January 1, 1918.

NORTHERN STATES POWER COMPANY, ST. PAUL, MINN.

In all new wholesale power contracts an increase of 10 per cent to net monthly bills has been provided.

New Hampshire.

TWIN STATE GAS AND ELECTRIC COMPANY, DOVER, N. H.

This company has increased its power rates by a provision adding to the customers' bills the amount of $0.005 net per kilowatt-hour for the amount of monthly consumption.

PLYMOUTH ELECTRIC LIGHT COMPANY, PLYMOUTH, N. H.

The New Hampshire Public Service Commission approved an application to increase rates to cover the increased cost of coal and labor.

ROCKINGHAM COUNTY LIGHT AND POWER COMPANY, PORTSMOUTH, N. H.

The New Hampshire Public Service Commission approved the following coal clause to be added to the power contracts:

"The price for each kilowatt-hour of electric current taken under any contract made under this schedule shall be subject each month to an addition or a decrease of forty-five one-thousands of a cent ($0.00045) per kilowatt-hour for each whole ten per cent (10%) of forty cents ($0.40) of increase or decrease from the normal price for bituminous coal at four dollars ($4.00) per long ton f. o. b. the company's wharf, during that month."

New Jersey.

PUBLIC SERVICE ELECTRIC COMPANY, NEWARK, N. J.

The following coal clause has been added to the wholesale power rate effective in the cities of Bayonne, Camden, East Orange, Elizabeth, Hoboken, Jersey City, Newark, Passaic, Paterson, Perth Amboy, Trenton and West Hoboken:

"The Energy Charge is increased or decreased 0.039 cent per kilowatt-hour, for each 35 cent increase over $4.00 or decrease below $3.50 in the price per long ton of bituminous coal delivered at Company's generating station during the month."

New York.

New York City. Borough of the Bronx.

THE BRONX GAS AND ELECTRIC COMPANY.

The minimum charge for general power service is increased from $1.00 to $2.00 per horsepower connected.

The wholesale light and power schedule has the following coal clause:

"The rate is increased or decreased, each month, 0.06 cent per kilowatt-hour for each 10 per cent of increase or decrease in price of coal from $3.00 per long ton, f. o. b. company's dock during that month."

Boroughs of Manhattan and the Bronx.

THE NEW YORK EDISON COMPANY. THE UNITED ELECTRIC LIGHT AND POWER COMPANY.

The following coal clause has been added to primary lighting and power rate in Manhattan; the primary lighting and power rate in the Bronx; the primary power rate for general construction work; the primary power rate for submarine tunnel construction; and the primary power rate for refrigeration and ice-making sevice:

"Add 0.035 cent per kilowatt-hour to the Energy Charge for each 30 cent increase in price of coal above $3.00 per long ton; deduct 0.35 cent per kilowatt-hour for each 30 cent drop in price of coal below $3.00 per long ton delivered."

Borough of Brooklyn.

EDISON ELECTRIC ILLUMINATING COMPANY OF BROOKLYN.

The demand charge for primary high-load-factor lighting and power service was recently increased. The demand charge was:

$80.00 per kilowatt per year on guarantee of $12,000 yearly.
$75.00 per kilowatt per year on guarantee of $30,000 yearly.
$70.00 per kilowatt per year on guarantee of $45,000 yearly.

The demand charge now in effect is as follows:

$85.00 per kilowatt per year on guarantee of $12,000 yearly.
$80.00 per kilowatt per year on guarantee of $18,000 yearly.
$75.00 per kilowatt per year on guarantee of $30,000 yearly.
$70.00 per kilowatt per year on guarantee of $45,000 yearly.

The prompt payment discount has been eliminated.

The prompt payment discount on wholesale power rate has been changed from 10 per cent, 10 days, on the energy charge to 2 per cent.

The following coal clause is applicable to any contract if the current supplied thereunder is at a potential greater than 240 volts:

"The price for each kilowatt-hour supplied at a potential in excess of 240 volts shall be subject each month to an addition or a reduction of 0.035 cent per kilowatt-horu for each 10 per cent of increase or decrease from the normal price of bituminous coal of $3.00 per long ton, f. o. b. New York Harbor during the month."

Borough of Queens.

NEW YORK AND QUEENS ELECTRIC LIGHT AND POWER COMPANY.

The following coal clause is applicable to retail power service:

"When consumption in any month exceeds 10,000 horsepower-hours the net rate per horsepower-hour is increased or decreased 0.0375 cent per horsepower for each 10 per cent increase or decrease respectively, in price of bituminous coal of $3.00 per long ton f. o. b. New York Harbor in that month."

The following coal clause is applicable to whole-

sale light and power, and combined lighting and power:

"When consumption during any one month exceeds 7500 kilowatt-hours the net rate is subject to an increase or decrease of 0.05 cent per kilowatt-hour for each 10 per cent increase or decrease, respectively, in price of bituminous coal for $3.00 per long ton, f. o. b. New York Harbor during that month."

The following coal clause is applicable to high tension lighting and power; high tension lighting and power (high load-factor); and primary refrigeration service:

"The net rate shall be increased or decreased 0.05 cent per kilowatt-hour for each 10 per cent increase or decrease, respectively, in the price of bituminous coal of $3.00 per long ton, f. o. b. New York Harbor during that month."

Borough of Richmond.

RICHMOND LIGHT AND RAILROAD COMPANY.

A coal clause has been inserted in the general lighting rate, the retail power rate, the wholesale lighting and power rate, and the primary service rate, which reads as follows:

"The rate is increased 0.15 cent per kilowatt-hour for each $1.00 increase in price of coal above $4.00 per long ton; the rate is decreased 0.15 cent per kilowatt-hour for each $1.00 decrease in price of coal below $3.00 per long ton.

THE UTICA GAS AND ELECTRIC COMPANY, UTICA, N. Y.

The company increased its rates for general power service and for high load-factor power service.

The former rates in effect for general power were:

6.5 cents per kilowatt-hour for the first 50 kilowatt-hours.
5.5 cents per kilowatt-hour for the next 50 kilowatt-hours.
4.5 cents per kilowatt-hour for the next 50 kilowatt-hours.
3.5 cents per kilowatt-hour for the next 100 kilowatt-hours.
3 cents per kilowatt-hour for the next 400 kilowatt hours.
2.5 cents per kilowatt-hour for the next 1500 kilowatt-hours.
2 cents per kilowatt-hour for the next 850 kilowatt-hours.
1.5 cents per kilowatt-hour for the next 3000 kilowatt-hours.
1.25 cents per kilowatt-hour for the next 94,000 kilowatt-hours.
1.2 cents per kilowatt-hour for the next 100,000 kilowatt-hours.
1.15 cents per kilowatt-hour for all excess over 200,000 kilowatt-hours.
No bill under 1.2 cents per kilowatt-hour net.

The new rates are:

7.5 cents per kilowatt-hour for the first 50 kilowatt-hours.
6.5 cents per kilowatt-hour for the next 50 kilowatt-hours.
5.5 cents per kilowatt-hour for the next 50 kilowatt-hours.
4.5 cents per kilowatt-hour for the next 150 kilowatt-hours.
3.5 cents per kilowatt-hour for the next 400 kilowatt-hours.
3 cents per kilowatt-hour for the next 800 kilowatt-hours.
2.5 cents per kilowatt-hour for the next 1500 kilowatt-hours.
2 cents per kilowatt-hour for the next 3000 kilowatt-hours.
1.6 cents per kilowatt-hour for the next 94,000 kilowatt-hours.
1.5 cents per kilowatt-hour for the next 100,000 kilowatt-hours.
1.45 cents per kilowatt-hour for excess.
No bill under 1.5 cents per kilowatt-hour net.

The rate for high load-factor power was increased from 1.2 cents to 1.5 cents per kilowatt-hour.

THE YONKERS ELECTRIC LIGHT AND POWER COMPANY, YONKERS, N. Y.

A rate for primary lighting and power service has been added to its schedule. The rate contains the following coal clause:

Adjustment in rate due to coal price fluctuation add 0.05 cent per kilowatt-hour to the energy charge for each 20 cents of increase of coal above $3 per long ton; deduct 0.05 cent per kilowatt-hour from the energy charge for each 30 cents of decrease in price of coal below $3 per long ton.

North Dakota.

THE UNION LIGHT, HEAT AND POWER COMPANY, FARGO, N. D.

The company has announced a 10 per cent war emergency surcharge to be added to electric bills after January 1, 1918.

RED RIVER POWER COMPANY, GRAND FORKS, N. D.

The company has announced a war surcharge of 10 per cent to be added to electric light and power bills until costs of materials and supplies again become normal.

Ohio.

THE CLEVELAND ELECTRIC ILLUMINATING COMPANY, CLEVELAND, O.

The energy charge for commercial light and power service has been increased from:

2 cents to 2.8 cents per kilowatt-hour for the first 2500 kilowatt-hours.
0.8 cent to 1.1 cents per kilowatt-hours for the next 35,000 kilowat-hours.
0.5 cent to 0.6 cent per kilowatt-hour for the next 310,000 kilowatt-hours.
0.4 cent to 0.5 cent per kilowatt-hour for excess.

A coal clause was added to the company's rates for high-tension alternating-current service to electric railways.

THE COLUMBUS RAILWAY, POWER AND LIGHT COMPANY, COLUMBUS, O.

The commercial light and power rates have been increased from 8 cents per kilowatt-hour for the first 6 per cent of the maximum possible demand and 4 cents per kilowatt-hour for excess, to 8 cents per kilowatt-hour for the first 10 per cent of the maximum possible demand and 5 cents per kilowatt-hour for excess.

The energy charge for general power service was increased as follows:

The former rates were:

1.5 cents per kilowatt for the first 2500 kilowatt-hours.
1.25 cents per kilowatt-hour for the next 2500 kilowatt-hours.
1 cent per kilowatt-hour for the next 2500 kilowatt-hours.
.75 cent per kilowatt-hour for excess.

The present rates are:

2 cents per kilowatt-hour for the first 2500 kilowatt-hours.
1.75 cents per kilowatt-hour for the next 2500 kilowatt-hours.
1.5 cents per kilowatt-hour for the next 2500 kilowatt-hours.
1.25 cents per kilowatt-hour for the next 2500 kilowatt-hours.
1 cent per kilowatt-hour for all excess.

The energy charge of the primary power rate was increased. The former rates were:

1.5 cents per kilowatt-hour for the first 2500 kilowatt-hours.
1.25 cents per kilowatt-hour for the next 2500 kilowatt-hours.
1 cent per kilowatt-hour for next 2500 kilowatt-hours.
.75 cent per kilowatt-hour for the next 92,500 kilowatt-hours.
.6 cent per kilowatt-hour for the next 200,000 kilowatt-hours.
.5 cent per kilowatt-hour for excess.

The present rates are:

2 cents per kilowatt-hour for the first 2500 kilowatt-hours.
1.75 cents per kilowatt-hour for the next 2500 kilowatt-hours.
1.5 cents per kilowatt-hour for the next 2500 kilowatt-hours.
1.25 cents per kilowatt-hour for the next 2500 kilowatt-hours.
1 cent per kilowatt-hour for the next 90,000 kilowatt-hours.
.85 cent per kilowatt-hour for the next 200,000 kilowatt-hours.
.75 cent per kilowatt-hour for the excess.

The battery charging rate for automobile charging was increased from 5 cents to 6.5 cents per kilowatt-hour.

DAYTON POWER AND LIGHT COMPANY, DAYTON, O.

The 5 per cent payment discount was withdrawn from the commercial lighting rate, the moving picture rate, the small power rate and the suburban power rate.

A net addition of 0.2 cent per kilowatt-hour was made to the large power rate; primary power; electric railway power; the battery charging rate and the suburban large power rate. This addition is applied after all quantity and prompt payment discounts have been deducted from bill as figured under the previous schedule.

SPRINGFIELD LIGHT, HEAT AND POWER COMPANY, SPRINGFIELD, O.

The energy charge of the commercial lighting rate has been increased from 4 cents per kilowatt-hour for all current consumed to 5 cents per kilowatt-hour for the first 90 hours' use of demand and 3 cents per kilowatt-hour for excess.

The rate for another commercial lighting (optional) was increased from 5 to 6 cents per kilowatt-hour.

The rates for display lighting were increased.

The energy charge for general power service was increased 0.5 cent per kilowatt-hour.

The rates for optional power service were increased from

5 cents per kilowatt-hour for the first 30 kilowatt-hours per horsepower connected.
3 cents per kilowatt-hour for excess.

The present rates are:

5.5 cents per kilowatt-hour for the first 30 kilowatt-hours per horsepower connected.
4 cents per kilowatt-hour for excess.

The rate for battery charging is increased. The former rate read:

Customer charge: $1.50 net, plus an
Energy charge of: 3 cents per kilowatt-hour.
Minimum charge: $1.50.

The present rate reads:

Customer charge: $2.00 net, plus an
Energy charge of: 4 cents per kilowatt-hour.
Minimum charge: $2.00.

YOUNGSTOWN AND SHARON STREET RAILWAY COMPANY, YOUNGSTOWN, O.

The energy charge for wholesale lighting and power service was increased from:

3 cents to 3.5 cents per kilowatt-hour for the first 500 kilowatt-hours.
2.5 cents to 3 cents per kilowatt-hour for the next 1000 kilowatt-hours.
2 cents to 2.5 cents per kilowatt-hour for the next 2000 kilowatt-hours.
1.5 cents to 1.7 cents per kilowatt-hour for the next 3000 kilowatt-hours.
1.25 cents to 1.4 cents per kilowatt-hour for the next 4000 kilowatt-hours.
1.1 cents to 1.2 cents per kilowatt-hour for the next 50,000 kilowatt-hours.
1 cent to 1.1 cents per kilowatt-hour for the next 100,000 kilowatt-hours.
.65 cent to .75 cent per kilowatt-hour for excess.

The energy charge for wholesale power service was increased from:

3 cents to 3.5 cents per kilowatt-hour for the first 1000 kilowatt-hours.
1.1 cents to 1.3 cents per kilowatt-hour for the next 100,000 kilowatt-hours.
.55 cent to .65 cent per kilowatt-hour for the next 100,000 kilowatt-hours.
.5 cent to .6 cent per kilowatt-hour for all excess.

The energy charge rates for primary power and wholesale primary power service have been increased twice. The energy charge for primary power has been increased from:

1 cent to 1.2 cents to 1.29 cents per kilowatt-hour for the first 100,000 kilowatt-hours.
.5 cent to .6 cent to .79 cent per kilowatt-hour for the next 100,000 kilowatt-hours.
.45 cent to .55 cent to .74 cent per kilowatt-hour for excess.

The energy charge for wholesale primary power has been increased from:

.9 cent to 1.1 cents to 1.19 cents per kilowatt-hour for the first 100,000 kilowatt-hours.
.45 cent to .55 cent to .74 cent per kilowatt-hour for the next 100,000 kilowatt-hours.
.4 cent to .5 cent to .69 cent per kilowatt-hour for excess.

The following coal clause was also added to both primary power and wholesale primary power schedules:

"The above energy charge is adjusted each month to changes in the price of coal on the basis of 0.01 cent per kilowatt-hour for each 5 cents increase over $2 or decrease below $1.70 in average price per ton of coal delivered and in stock during the month. In order to comply with the requirements of the Ohio Commission this does not appear in the schedule as a coal clause, but the company files a new schedule each month with the Commission, in which the energy charges are based on the average price of coal for that month."

Pennsylvania.

PENN CENTRAL LIGHT AND POWER COMPANY, ALTOONA, PA.

The general lighting rates have been increased from 8 to 9 cents per kilowatt-hour for the first 30 hours' use of demand and from 4 to 5 cents per kilowatt-hour for excess.

The general power rates have been increased from 5.55 to 6 cents per kilowatt-hour for the first 30 hours' use of demand and from 2.77 to 3 cents per kilowatt-hour for excess. The prompt payment discount has been discontinued.

The following coal clause was added to the wholesale power rate, wholesale high tension power rate and to the night power rate:

"An additional charge of 0.01 cent per kilowatt-hour for each increase of 10 cents for gross ton of coal when coal exceeds $1.35 per gross ton."

ERIE COUNTY ELECTRIC COMPANY. ERIE LIGHTING COMPANY, ERIE, PA.

The following coal clause has been added to the wholesale power rates of both companies:

"For each 10 cents or fraction thereof increase in the price of Pittsburgh coal (or its equivalent) as paid by the company (ranging from 13,000 to 13,600 b. t. u. per pound) over and above $2 per net ton, delivered at the company's plant in the city of Erie, there shall be a charge of 0.03 cents for each kilowatt-hour of energy consumed."

NEW CASTLE ELECTRIC COMPANY, NEW CASTLE, PA.

The energy charge for wholesale lighting and power service was increased from:

3 cents to 3.5 cents per kilowatt-hour for the first 500 kilowatt-hours.
2.5 cents to 3 cents per kilowatt-hour for the next 1000 kilowatt-hours.
2 cents to 2.5 cents per kilowatt-hour for the next 2000 kilowatt-hours.
1.5 cents to 1.7 cents per kilowatt-hour for the next 3000 kilowatt-hours.
1.25 cents to 1.4 cents per kilowatt-hour for the next 4000 kilowatt-hours.
1.1 cents to 1.2 cents per kilowatt-hour for the next 50,000 kilowatt-hours.
1 cent to 1.1 cents per kilowatt-hour for the next 100,000 kilowatt-hours.
.65 cent to .75 cent per kilowatt-hour for excess.

The energy charge for the wholesale power rate was increased from:

3 cents to 3.5 cents per kilowatt-hour for the first 1000 kilowatt-hours.
1.1 cents to 1.3 cents per kilowatt-hour for the next 100,000 kilowatt-hours.
.55 cent to .65 cent per kilowatt-hour for the next 100,000 kilowatt-hours.
.5 cent to .6 cent per kilowatt-hour for excess.

The following coal clause has been added to the rates for primary power and large primary power service:

The energy charge is increased or decreased 0.01 cent per kilowatt-hour for each 5 cent increase over $2 or decrease below $1.70, respectively, in average price per ton of coal delivered and in stock during the month.

THE PHILADELPHIA ELECTRIC COMPANY, PHILADELPHIA, PA.

A coal clause has been added to the primary service (high load-factor), which is as follows:

The energy charge is increased or decreased each month 0.005 cent per kilowatt-hour for each 5 cent increase above $3.50 or decrease below $3 in price per ton of coal delivered during the month.

DUQUESNE LIGHT COMPANY, PITTSBURGH, PA.

The energy charges for wholesale lighting and power service and for off-peak service are increased 0.01 cent per kilowatt-hour for each 5-cent increase above $1.25 per ton; and are decreased 0.01 cent per kilowatt-hour for each 5 cents decrease below $1.05 per ton of coal delivered.

SCRANTON ELECTRIC COMPANY, SCRANTON, PA.

The company increased its rates for general power (demand basis) and for wholesale power by changing its quantity discounts.

Another wholesale power rate was increased 5 mills per kilowatt-hour and its quantity discount changed.

Rhode Island.

BLACKSTONE VALLEY GAS AND ELECTRIC COMPANY, PAWTUCKET, R. I.

A coal clause was added to the wholesale power rate and the off-peak lighting rate.

BLACKSTONE VALLEY GAS AND ELECTRIC COMPANY, WOONSOCKET, R. I.

The company added a coal clause applicable to the wholesale power service. A provision was also added to the minimum charge which reads as follows:

The price per kilowatt-hour after deducting the demand discount, but before deducting the prompt payment discount shall in no event be less than 1 cent per kilowatt-hour.

South Carolina.

CHARLESTON CONSOLIDATED RAILWAY AND LIGHTING COMPANY, CHARLESTON, S. C.

The following coal clause was added to the whole-

sale power and off-peak power rates:

The energy charge in any month is increased 0.002 cent per kilowatt-hour for each 1 cent increase over $3.50 in price per short ton of coal delivered during the three preceding months.

South Dakota.

NORTHERN STATES POWER COMPANY, SIOUX FALLS, S. D.

The company has announced a 10 per cent war emergency surcharge applicable to electric light and power bills effective January 1, 1918.

Tennessee.

CHATTANOOGA RAILWAY AND LIGHT COMPANY, CHATTANOOGA, TENN.

The retail power rates were increased.

The present rate is:

6 cents per kilowatt-hour for the first 75 hours' use of connected load.
4 cents per kilowatt-hour for the next 75 hours' use of connected load.
3 cents per kilowatt-hour for the excess.
Minimum charge: $1.41 per kilowatt contracted for.

The wholesale power rate was:

Demand charge: $1 per kilowatt of demand, plus an
Energy charge of: 1.5 cents per kilowatt-hour for the first 2000 kilowatt-hours.
1.25 cents per kilowatt-hour for the next 2000 kilowatt-hours.
1 cent per kilowatt-hour for the next 2000 kilowatt-hours.
0.75 cent per kilowatt-hour for the next 6000 kilowatt-hours.
0.50 cent per kilowatt-hour for excess.
Minimum charge: $1 net per kilowatt contracted for, but not less than $25.

The new rates are:

Demand charge: $1.25 per kilowatt of demand, plus an
Energy charge of: 4 cents per kilowatt-hour for the first 500 kilowatt-hours.
2 cents per kilowatt-hour for the next 1000 kilowatt-hours.
1.5 cents per kilowatt-hour for the next 1500 kilowatt- hours.
1 cent per kilowatt-hour for the next 17,000 kilowatt hours.
0.7 cent per kilowatt-hour in excess.
Minimum charge: $1.25 per kilowatt contracted for, but not less than $25.

Texas.

HOUSTON LIGHTING AND POWER COMPANY, HOUSTON, TEX.

The following fuel clause was added to the rates for wholesale power:

The energy charge is increased 0.01 cent per kilowatt-hour for each 2-cent increase in cost per barrel of oil.

Virginia.

VIRGINIA RAILWAY AND POWER COMPANY, NORFOLK, VA.

The following coal clause is applicable to wholesale lighting and power, wholesale industrial power, intermediate wholesale power, and primary wholesale power rates:

"On all contracts over one year, a coal rider provides for an increase or decrease in a rate per kilowatt-hour, depending upon price of coal. Base is $2.50 per short ton. Each decrease or increase of a complete 25 cents, decreases or increases price of current by 0.03 cent per kilowatt-hour."

VIRGINIA RAILWAY AND POWER COMPANY, RICHMOND, VA.

Coal clause, same as for Norfolk.

Washington.

PUGET SOUND TRACTION, LIGHT AND POWER COMPANY, TACOMA, WASH.

The rates for general power were:

Demand, 1 to 20 horsepower.
3 cents per kilowatt-hour for 80 hours use of demand.
2.5 cents per kilowatt-hour for 100 hours use of demand.
2 cents per kilowatt-hour for 150 hours use of demand.
1.5 cents per kilowatt-hour for 240 hours use of demand.
1 cent per kilowatt-hour for 460 hours use of demand or over.
Demand, 21 to 100 horsepower.
3 cents per kilowatt-hour for 70 hours use of demand.
2 cents per kilowatt-hour for 125 hours use of demand.
1.5 cents per kilowatt-hour for 200 hours use of demand.
1 cent per kilowatt-hour for 400 hours use of demand.
0.8 cent per kilowatt-hour for 550 hours use of demand.
0.6 cent per kilowatt-hour for 720 hours use of demand and over.
Demand, 101 horsepower or over:
3 cents per kilowatt-hour for 70 hours use of demand.
2 cents per kilowatt-hour for 120 hours use of demand.
1.5 cent per kilowatt-hour for 190 hours use of demand.
1 cent per kilowatt-hour for 336 hours use of demand.
0.8 cent per kilowatt-hour for 430 hours use of demand.
0.6 cent per kilowatt-hour for 590 hours use of demand.
0.5 cent per kilowatt-hour for 720 hours use of demand and over.

The rates now in effect are:

Demand, 1 to 20 horsepower:
3 cents per kilowatt-hour for 0 to 80 hours use of demand.
2.5 cents per kilowatt-hour for 100 hours use of demand.
2 cents per kilowatt-hour for 150 hours use of demand.
1.5 cents per kilowatt-hour for 240 hours use of demand.
1.25 cent per kilowatt-hour for 320 hours use of demand and over.
Demand, 21 to 100 horsepower:
3 cents per kilowatt hour for 0 to 70 hours use of demand.
2.5 cents per kilowatt-hour for 90 hours use of demand.
2 cents per kilowatt-hour for 125 hours use of demand.
1.5 cents per kilowatt-hour for 200 hours use of demand.
1.25 cents per kilowatt-hour for 270 hours use of demand.
1.125 cents per kilowatt-hour for 335 hours use of demand and over.
Demand, 101 horsepower and over:
3 cents per kilowatt-hour for 0 to 70 hours use of demand.
2.5 cents per kilowatt-hour for 85 hours use of demand.
2 cents per kilowatt-hour for 120 hours use of demand.
1.5 cents per kilowatt-hour for 190 hours use of demand.
1.25 cents per kilowatt-hour for 250 hours use of demand.
1 cent per kilowatt-hour for 336 hours use of demand and over.

West Virginia.

APPALACHIAN POWER COMPANY, BLUEFIELD, W. VA.

The West Virginia Public Service Commission has authorized the company to make a 20 per cent surcharge to net bills for electricity served to customers having a connected load of 50 horsepower or more.

Wisconsin.

THE MILWAUKEE ELECTRIC RAILWAY AND LIGHT COMPANY, MILWAUKEE, WIS.

An increase in electric service rates was made effective October 25, 1917, of .31 cent per kilowatt-hour for all energy sold to any one customer per month in excess of 1000 kilowatt-hours, exclusive of current sold to municipalities on existing contracts with other utilities, and on existing contracts for water power service.

The following companies have increased their rates, although data as to the amount are not available:

CAMBRIDGE GAS, ELECTRIC LIGHT AND POWER COMPANY, CAMBRIDGE, MD.

CHESTERTOWN ELECTRIC LIGHT AND POWER COMPANY, CHESTERTOWN, MD.

CONSOLIDATED GAS, ELECTRIC LIGHT AND POWER COMPANY OF BALTIMORE, BALTIMORE, MD. (Only with respect to large power users.)

CRISFIELD ICE MANUFACTURING COMPANY, CRISFIELD, MD.

DELMARVIA UTILITIES COMPANY, OCEAN CITY, MD.

EASTON UTILITIES COMPANY, EASTON, MD.

HAVRE DE GRACE ELECTRIC COMPANY, HAVRE DE GRACE, MD.

IDLEWILD ELECTRIC LIGHT AND POWER COMPANY, FEDERALSBURG, MD.

PENINSULAR ELECTRIC LIGHT AND POWER COMPANY, DENTON, MD.

SALISBURY LIGHT, HEAT AND POWER COMPANY, SALISBURY, MD.

SNOW HILL ELECTRIC LIGHT AND POWER COMPANY, SNOW HILL, MD.

OHIO SERVICE COMPANY, COSHOCTON, O.

NORTHWESTERN OHIO LIGHT AND POWER COMPANY, VAN WERT, O.

THE CENTRAL POWER COMPANY, NEWARK, O.

TOLEDO RAILWAYS AND LIGHT COMPANY, TOLEDO, O.

NORTHERN OHIO TRACTION AND LIGHT COMPANY, AKRON, O.

UNION GAS AND ELECTRIC COMPANY, CINCINNATI, O.

CALIFORNIA-OREGON POWER COMPANY, SAN FRANCISCO, CAL.

TUALATIN VALLEY ELECTRIC COMPANY, SHERWOOD, ORE.

Power-Plant Practice During 1917

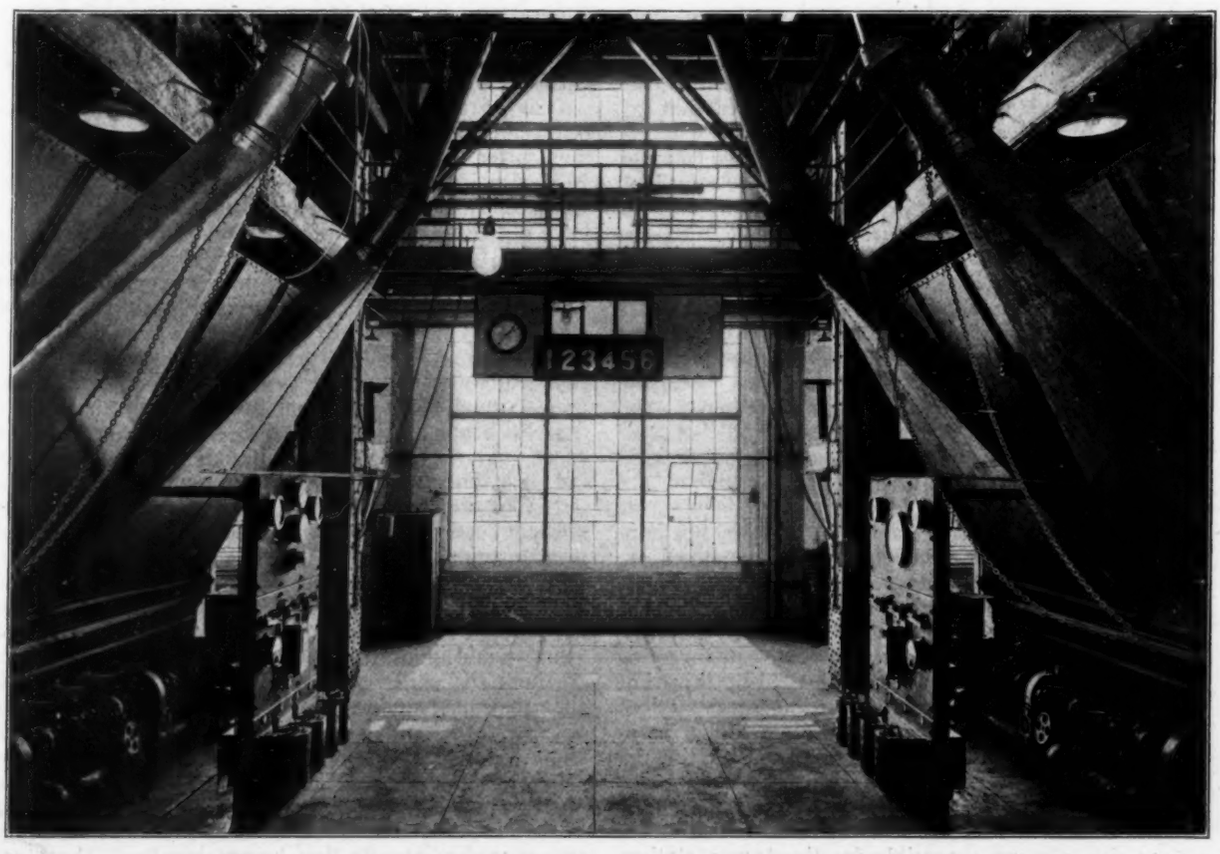
A Review of the Experiencies Growing Out of the Shortage of Coal and Labor and a Resume of the Many Economies That Have Been Effected in the Boiler Room

By I. L. KENTISH-RANKIN

WE all know too well the fuel situation of the past year. The crippled railroads, regulated almost out of existence and having become impoverished, failed when needed most. The miners went on strike when the season for coal shipments by land and water was most favorable. The price boosts and manipulation by mine owners and middlemen. The scarcity occasioned by transient and sometimes ill-advised embargoes made or thought necessary by railroad congestion or local coal famine. Excited and occasionally unwise advice hastily given out. Soaring prices and dwindling supplies on hand with increasing consumption and greater demand. This, in the main, expresses roughly the fuel situation, omitting the suffering, the hardship and injustice and pecuniary loss that has accompanied it. We know, too, that while coal has become vastly more valuable economically and intrinsically, water powers which in many instances might be used efficiently to replace coal as a form of energy are being deliberately and wantonly wasted without apparent compunction. The oil situation which because less is heard is no less real, is one of increasing demand, with production always less than the demand. These are the things that we have learnt, truths brought home with unpleasant force until today fuel has been placed with food as the two powerful factors involved in winning the war.

Deploring and criticising the fuel situation gains nothing unless we learn and by learning profit by the lesson. It should be universally admitted after the past year's experiences that coal is a utility, not a private possession. It is a priceless national asset; not merely a deposit of raw material for the owner to sell where and when he chooses, at whatever price he pleases, for use or abuse by the buyer as he wills. These things are being found out, and it is to be hoped will be appreciated and acted upon to the full before conditions revert to normal and the experiences of the past year are forgotten.

The past year in the majority of boiler rooms throughout the country has been one of unexpected difficulties because unforeseen and uncontrollable conditions have had to be met suddenly without previous preparation, and frequently without experience. And more intensive work in the way of higher loads, usually overloads, sustained for prolonged hours with



View of Part of Boiler Room of Connors Creek Station of Detroit Edison Company, Detroit, Mich., Showing Instrument and Control Panels for Regulating These Big Boilers, Each of Which Is Rated 2365 Horsepower.

uncertain supplies and qualities of fuel and a labor shortage have not only prevented efficient preparation but have tended to augment the seriousness of the situation and exaggerate the difficulties. Increased loads and inability to obtain increased equipment has meant more intensive use of existing material at higher energy densities. Variable quantity and quality of coal and labor have made operation and maintenance more difficult and often very inefficient. These are some of the problems of the hour in the boiler rooms. Each boiler room has its own problem or problems, but in the main they differ only in magnitude and degree.

Looking back, it is interesting to see what difficulties have occurred in general, how they might have been partially prevented, and how they may be guarded against in the future. Progress in the boiler room has been slow, but necessity is the mother of invention, in this instance improvement not invention is all that is required, and necessity is forcing improvements. It is chiefly the desire that is needed to improve the boiler room, for where there is the desire there is usually the will, and where there is the will for accomplishment there usually comes successful attainment. Patriotism appears to be doing much toward the betterment of boiler rooms; but the scarcity and high price of coal—which affects the pocketbook—is doing much. Perhaps the pinch of high prices for coal and labor, if they enable serious and permanent improvements in operating economy, are after all a blessing in disguise, and if so are the only bright lights of the unfortunate labor and fuel situation today.

What the Boiler Rooms Have Learned.

The last year with its fuel, car and labor situations has brought out the fact, perhaps not previously appreciated to the full, that the flexibility of a plant depends upon each and every factor involved. Segregation of individual performances such as that of boiler, of furnace, of economizer is advisable when dealing with the individual factors, and in determining the efficiency of the whole. But flexibility of plant performance comes only after considering the plant as a whole first, and the individual factors and functions afterward, bearing in mind that each function as an integral part of the whole must be considered individually as well. Apparent lack of this has caused great inconvenience, high operating cost and even failure during the last few months. Text-book designs cater to normal conditions, not to the unforeseen. And the happenings of the last year were unforeseen to the extreme. Preparedness against unparalleled car shortages and coal scarcity, and the utilization of fuels for which plants were ill-adapted, lack of labor, deteriorating equipment and loads and load-factors far in excess of those ever dreamed of by the most optimistic central-station manager would have saved expense and many near-failures. But preparedness is a matter of investment whether initially in engineering skill or later in equipment. And sound engineering requires conservatism when it comes to investing in safeguards against improbabilities. But this time the improbable happened. The large central stations have suffered, perhaps all of them, from higher loads and load-factors, scarcity of equipment and the use of coals of lower grade than were originally intended to be used.

The smaller plants have suffered more, lacking the preparative measures possible by the larger stations and without the moral and commercial standing to obtain what they wanted. The problems of the last year have been those of fuel, its delivery, utilization and disposal of refuse; of labor, scarcity of unskilled as well as skilled labor; of supplying loads in excess of capacity; of economy of performance.

What the Labor Situation is Teaching.

The labor situation, never the best in the boiler room, has gone from bad to worse. Managements that once chose laborers when they should have picked chemists can no longer pick and choose, for the choice is no longer theirs. It is a matter of taking what little comes along, and endeavoring to keep it. Labor from the boiler room has migrated to more pleasant, better-paid paths of effort, and the fact that correct illumination, better ventilation, the few comforts to which every man is entitled, and healthy living conditions are necessary if labor is to be retained, if esprit de corps and interest in the work and endeavor to obtain proper performance are to exit is beginning to be better appreciated. Men will not stay where working conditions are bad, where they are called upon to do the work that rightly belongs to machines, when there are other jobs calling, easier work to do and more money for doing it.

The scarcity of labor has made boiler room operation difficult, for this fact alone. That many plants have had to burn fuels with which they had no previous experience and for which their equipment was none too well adapted has only added to the difficulties. Moreover ,high sustained overloads with inability to make repairs has caused accelerated deterioration and loss of efficiency. Antiquated and dilapidated ash and coal-handling equipment which has fallen into bad conditions, to fail when made to do work for which it was never intended; clinker and clinker troubles, dirty boiler rooms, filled with the acid-laden fumes that so often accompanies them, drives labor away rather than attracts it, especially in times of prosperity.

It is of course impossible to suddenly develop interest amongst men who have long before found almost utter lack of interest amongst the management. It is also impossible to breed interest with men who come today and go tomorrow. But existing conditions have not come about suddenly, and there should be no occasion for surprise that many boiler rooms are today suffering from the shortsighted policy of the management toward their boiler rooms and boiler-room forces.

There may be palliatives as regards the labor situation, but there is only one solution. That is to eliminate manual labor wherever at all possible. Usually it is an economical move to do so, considering labor costs. At the present time it appears the only way out of a dilemma. Moreover the elimination of manual labor and control usually brings with it increased efficiency and always more uniformly sustained and predeterminable results. The boiler room will probably never be a one-man affair, however, even when all the automatic appliances that deserve to be used are used. But it should be as immune from labor scarcity and ignorance as humanly possible. But even so those that still remain should be taught their work that they may understand, and in understanding take an interest. And working conditions must be such that men remain instead of quitting. Interest, laxity or enthusiasm must come from the management, and should not be expected from the laborer working without thanks who has least to gain. It is sustained not sporadic interest that brings results. There appears a great need for a movement toward boiler-room betterment as well as improved performance,

and the vast saving that will come from it with high reigning coal prices should act now if ever as an incentive to every management to place its plants upon a business-like basis.

Mechanical Stokers Find Favor.

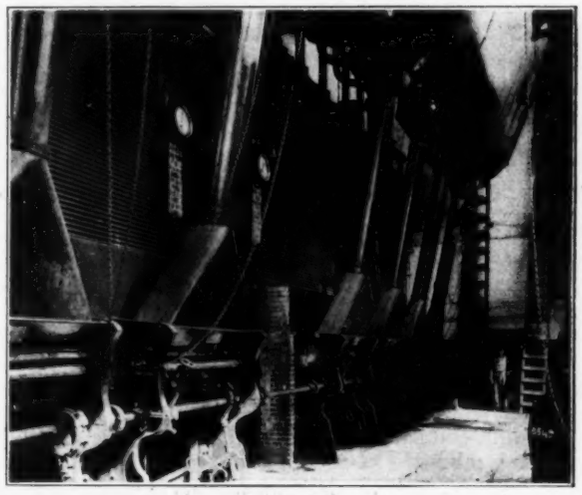
One of the outstanding features of the year has been the rapid adoption of mechanical stokers in place of hand firing. The necessity for burning coal more economically has of course been one reason, because the rising coal prices have made stokers a paying proposition. Immunity from labor scarcity has been another reason that has been a powerful factor, which of course likewise lowers the operating cost. Difficulties in living up to civic smoke ordinances has been another incentive for the adoption of the underfeed stoker with high volatile coals. But perhaps the two main reasons for the marked increasing in the number of mechanical stokers are the necessity for increasing steam-making capacity and the reduction of overall labor, fuel and maintenance costs. Time and again installation of mechanical stokers under existing equipment has increased steaming capacity from 100 to 200 per cent continuous, although lack of coal and ash-handling facilities and other conditions have prevented the mechanical stoker being utilized to the full.

Perhaps the two most noticeable things as regards stoker performance are that of the high continuous combustion rates possible with the underfeed stoker, 275 per cent continuous being reported time after time without difficulty; and the adoption of this type of stoker with its large overload capacity to coals which it was once thought could be burned only upon the chain-grate type of stoker. The chain-grate stoker has long been recognized as handling the high-volatile high-ash western coals satisfactorily for limited overload capacity. But the demand of late has been practically universal for large overload capacity in face of increased demand without ability to obtain additional boiler capacity, and the underfeed stoker with its wide range of capacity and flexibility has surprised its users. This type of stoker makes clinker, as theory dictates that it would, when burning coals high in fusible material and with comparatively low fusing temperatures as have the inferior grades of coal. But the problem has been one of choosing between a range of combustion rates up to 400 per cent with the likelihood of clinker or foregoing the clinker difficulties and obtaining rates of firing but slightly in excess of normal or increasing loss of fire in the ash pit for a small further capacity increase.

Not all the clinker troubles have been due to underfeeding, however, for the high ash and sulphur content of the coals with low ash-fusing temperatures and the high combustion rates have been to large degree responsible. The fact that coals now delivered are often very dirty, the dirt acting as a flux, also has tended to increase the clinkering of the refuse.

The clinker problem—and it appears to have been one of the problems of the year, so far as the Middle West is concerned at any rate—has been due, firstly, to the quality and condition of the coals used; secondly, the rates at which they have been burnt; and, thirdly, the way in which they have been burned. To overcome and reduce the seriousness of clinker various developments as to details of design of the various stokers have been made, making them adaptable for wider range of fuels and more intensive combustion rates. The steam or power dump has removed one great obstacle in the way of efficient furnace maintenance and is a radical move toward the reduction of muscle as a necessary requirement in the boiler room. The reciprocating bars, the self-dumping grates and the clinker grinders or cutters are other features reducing the clinker troubles inside the furnace; and the clinker grinder also outside, by making the size of clinker less formable.

The use of mechanical stokers with a wide over-



A Well Equipped Boiler Room With Mechanical Stokers, Coal and Ash-Handling Equipment. Plant of Thos. Wolstenholme & Sons Company, Philadelphia.

load capacity has brought a better understanding of the economy of forced ratings for load changes instead of increased boiler capacity, a matter assuming added importance of course when additional boiler capacity is practically unobtainable, as at this time. Moreover with the mechanical stoker and high combustion rates comes mechanical draft, with the appreciation that a blower is always more flexible than a stack.

With the mechanical control of fuel should come also the mechanical control of air to the fire, the supply of fuel and air being automatically co-ordinated for maximum commercial combustion efficiency. However, the automatic control has in some instances been abandoned, resulting in smoke, inefficiency and waste of fuel as well as a loss in capacity. With ever-changing labor the importance of automatic control of combustion assumes an even more important role than during normal times; as does also the necessity for supervising the automatic feature with frequent coal changes. The mechanical stoker should save coal and increase capacity if operated properly. But it has been obvious that in some instances equipment is being abused, as is also the process of co-ordinating fuel and air, to the detriment of capacity.

Clinker Makes Itself Objectionable.

Perhaps one of the outstanding difficulties following in the wake of the fuel situation has been that of clinker. Clinker is fused ash, and the fusion depends upon the chemical composition of the ash, and the temperature of fusion. Tendency of a coal to clinker depends to a large extent also upon the treatment of the fuel bed and the method of feeding fuel to the fire. Of late coals with ash of low melting temperature have been used where a year or so ago their use would have been hardly considered and the higher temperatures attained with coals whose ash melts at a lower temperature in addition to the fact that coals are delivered much dirtier now than previously, the shale and other substances further acting as a fluxing

agent for the ash, would lead one to expect the preponderance of clinker. A large part of the clinker trouble is unavoidable, being due to properties of the coal. On the other hand not a little has been due to lack of understanding on the part of the firemen, who have changed grades of coal but not their methods of handling them. But most of the trouble has been due to the increase of combustion temperatures incident with high rates of combustion simultaneous with the decrease of ash-fusing temperatures and the great increase in the proportion of ash to coal burnt. Coals containing 8 to 17 per cent ash have been replaced with ones containing anywhere from 25 to 35 per cent ash. So also the ash-melting temperatures of these coals have dropped from around 2600 degrees to 2000 degrees. Moreover the sulphur content has gone up, in the form of pyrites, while the increase of other fluxing agents has also tended to make the difficulties of clinker more pronounced.

Influence of Low-Grade Coals on Ash Disposal.

To a surprising extent the question of ashes and the disposal of noncombustible from the furnace has become a problem second only in importance to that of obtaining coal deliveries. The situation has most certainly emphasized the fact that a chain is as strong as its weakest link.

The use of coals with high ash content and low fusing temperature has caused the so-called ash or noncombustible to assume a form and quantity different to that previously encountered and often radically unsuited to the design of station and ash-handling equipment. A shortage of labor has added to the difficulty. Coals with 10 to 15 per cent ash have given place to coals with as high as 40 per cent ash. Moreover, demands for steam have increased the rate of burning and therefore added to the amount of noncombustible to be disposed of, an amount increased still further due to incomplete combustion and allied losses to the ash pit. As further increasing the difficulties of ash disposal the ash of previous months has become a clinker of large volume.

Facilities for disposing of this new type of noncombustible and with increased volume and weight have usually been lacking, as has also the labor. Too often ash pits have proved themselves of insufficient capacity for even conservative forcing of boilers by becoming clogged with clinker. In some cases the exits of the ash hoppers have been of smaller area than the individual lumps of clinker to be gotten out. Inability to move non-combustible with sufficient rapidity from the ash pit has caused the hot clinker to finally back up to the grate till grates have been burnt and warped. In some instances furnaces have to be banked until the ash hoppers could be emptied, with resulting loss of boiler capacity in time of need and waste of coal. These things are strictly chargeable to improper design or insufficient ash pit capacity compared to stoker capacity, and bring out forcibly the fact that the means for disposing of noncombustible should at least be capable of taking care of the stokers, whatever their rate of firing. However, mechanical stokers have been installed hurriedly under existing boilers and with a minimum of expense; coals that had never been burnt before have since come into continuous use and rates of burning have possibly doubled, both adding immensely to amount of clinker to be handled.

Difficulties as to clinker have not finished at the ash pit, for that is but one of the stages. The size of clinker has frequently proved a stumbling block where mechanical ash disposal has been in vogue. The clinker has been too large individually and has had to be broken up before it could be carried by the conveyors. Clinker breaking is not easy work, and where hot clinker has to be handled it is an unpleasant undertaking, usually necessitating an acid-laden atmosphere from steaming down the clinker to make it workable. With so many jobs available it becomes increasingly difficult to keep men at this work, which also affects the firemen and water tenders if the fumes from ash pits are able to reach up to the boiler room. Mechanical ash conveyors, in poor condition as result of shortage of labor and probable abuse as well as overwork due to the necessity of handling the greater quantities of noncombustible resulting from higher loads and higher load-factors as well as high ash content of the coals have played their part in harassing boiler-room management.

The limitations of ash pits, ash conveyors or labor shortage have been brought to light in many plants while also increasing the cost of operation. Car shortages have further emphasized the need for storage space for ashes, as also for coal, that removal of refuse from the ash pits need not be delayed because facilities are lacking for removal from the station. It should be further pointed out, perhaps not needlessly, that storage space for ashes and coal should be preferably carried on where seepage and drainage will not cause corrosion of station structures and neighboring pipe work at a lower level. Coal and clinker are both corrosive and hoppers and equipment should be protected and maintained in good repair. Prevention is usually cheaper and simpler than cure, and will be certainly found to be so where chemical action by wet coal and ashes is encountered. It is annoying in the extreme to find that coal hoppers are unfit for use when coal is available after strenuous efforts have been made to obtain it, or that conveyors have failed when needed most, yet such are common incidents.

There is another aspect of question of clinker disposal and storage space. Whereas the quantity of refuse to be disposed of has in some instances more than doubled, whilst cars for shipping it away come and go sporadically, the ability to dispose of this clinker may have become more difficult. Whereas at one time railroads and others were ready to take ashes away for use on tracks and construction work, today the demand has decreased, the ash has given place to clinker, which is not wanted, and the quantity of this clinker has increased. The result is that possibly the disposal of this refuse now assumes an added burden upon the expense of operating the boiler room, an expense that should be charged against the saving in price of coal, if any, and expense of high ratings.

After a year of difficult operation many boiler rooms now realize that attention to the disposal of noncombustible from the furnace is as important as the delivery of coal to the stokers. Cessation of either one will cause eventual shutdown. Moreover, the change from fairly good coals to low-grade coals with their high ash content and large amount of shale and other dirt, all requiring the burning of increased quantities of fuel for a definite quantity of steam produced, has emphasized the very important fact that the ratio between fuel fed to the furnace and refuse fed to the ash pit is not a constant, but a variable and a very changeable one. The lack of facilities for disposing of furnace refuse has made the labor situation of various plants more difficult than otherwise it would have been: it has prevented the large overload capacity of mechanical stokers and their ability to increase the capacity of the boilers from being utilized to the full: it has further added to the cost of operation and tended

to hasten the deterioration of the plant. Moreover, failure of the ash-handling equipment has in some cases prevented a favorable car situation from being used, and also resulted in demurrage charges that could otherwise have been saved. Every boiler room should have a dependable ash-handling system, whether mechanical or otherwise, and with ample capacity for whatever coals are used and whatever ratings are sustained. The car situation has brought realization of the value of rapid unloading and loading, while labor scarcity makes obvious the need for eliminating lost motion and needless work. While considering the ash and coal-handling system, the question of weighing both coal and ash for the whole plant and each individual furnaces deserves consideration. There are a number of rugged, reliable and foolproof machines on the market at this time working within reasonable accuracy. Too few companies weigh the coal they burn, and fewer still know how much refuse is thrown away. Operating economies cannot come until the workings of a plant and of each unit in the plant are known.

Boiler-Room Instruments Appreciated.

A boiler room with no other instrument for indicating what is going on than a steam pressure gauge may be likened to a submarine without a periscope. Such a condition is deplorable in the extreme and difficult to understand. Yet there are many such boiler rooms.

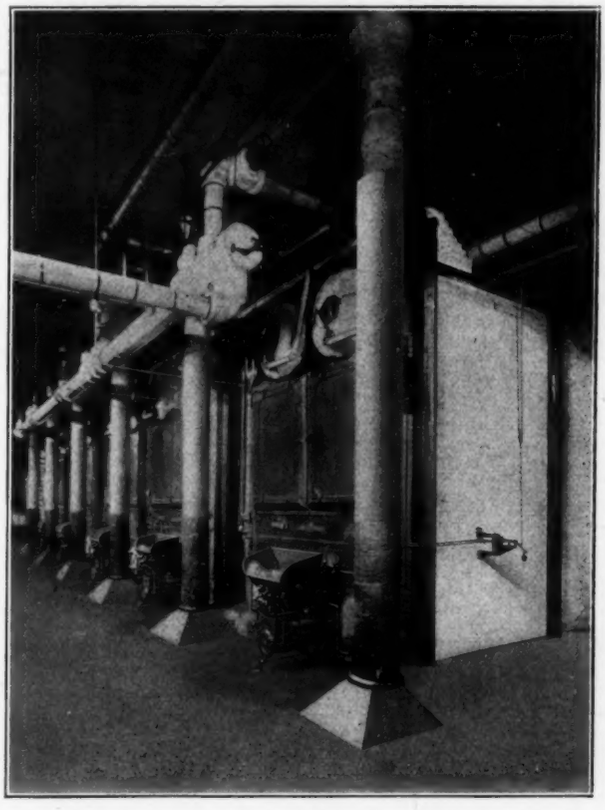
Never before were conditions more opportune than now for boiler-room instruments to pay a handsome return on the money invested in them. Orsats, or other form of CO_2 instrument, steam and water flowmeters, weighing devices for coal and ash, water columns and stack thermometers, each is a necessity if coal is to be conserved and the cost of operating reduced. In many boiler rooms it is not new equipment that is needed for better results, but new operating methods, and neither operating methods nor the accomplishments can be uniform nor known where records and instruments for determining them are absent.

With the coming of mechanical stokers and more intensive effort in the way of higher combustion and evaporation rates, and with reigning coal prices, is coming also realization that boiler-room instruments are a good investment, and a necessity. Many manufacturers report an unprecedented demand for such meters. But the instruments are little value unless used, and used correctly, and to assure that they shall be properly used, which means they must be properly maintained, some manufacturers report that men from some of the larger boiler rooms are beginning to come to the factory to learn the workings and calibrating of their instruments. This necessarily means business, seriously undertaken, and bodes well for boiler-room economy and actual conservation of coal. The small plants cannot afford to go to such extremes, however, and it appears very desirable to find a way for them to learn how to save coal also.

Records Assist Economy.

There is a very real need for suitable operating records and logs. These are kept without exception by the larger companies but are absent amongst the smaller ones to a surprising extent. Too many plants know little of what they are doing or how they are doing it. Too often the only factor that can be determined is the steam pressure, although coal measurements seem to be finding favor. Many stations that once kept records of the more important items in the boiler room have abandoned the practice, claiming there is too much load, too much to do and too few men to do it without worrying about records as to performance. Perhaps never were proper records more needed than now, apart from the high cost of fuel and the necessity for adopting every promising economy, because labor is on the move, and thus records made mentally are little use when new men come and the man that knows has gone away.

Simple yet complete records of the fundamental facts about boiler-room performance and knowledge for interpreting them are absolutely necessary if needed



A Battery of Well Equipped Boilers in Brooklyn (N. Y.) Plant.

improvements are to be brought quickly to light and that possible and permanent economies may be obtained. The distribution of standardized forms, one for each class of service, classified by size, purpose, and so forth, would appear to be one of the first processes in the way of seriously conserving coal or deciding upon who deserves coal and who not, and would quickly show what plants knew what they were doing and how they were doing it, and which plants knew nothing about anything other than they were making steam. Some such operating forms could with advantage be gotten out by federal, state or other ruling bodies or engineering societies, and would accomplish vastly more than advice as to how to do things when every way of telling what is being done is absent. Such records should be simple and complete, containing only the necessary items for the desired result; a beginning is better than no start at all. Curves and charts—pictures that visualize conditions make data expressive. A curve or chart knows no creed, no language; it is international, universal and will explain itself at a glance where figures may bewilder those unaccustomed to them, may be passed without understanding, and thus vital facts to safety

and economy are lost in a maze of data. The smaller plants want help, for selfish reasons. They are also patriotic in the spirit and would be so more actively were they shown how. It is the misuse of coal, not its use, that is calling for control and which is answerable for the fuel situation of the past year. Every plant should know how much coal it is using, how much of this is being wasted, and how much of this waste could be prevented; the quantity of steam and electricity produced daily and the cost of each upon a unit basis. The output, performance and cost of upkeep for every unit should be known, as also for the whole. It is necessary to know where heat is being wasted before the waste can be stopped. It is advisable to know the dollar value of that waste before spending or obtaining money to stop it. But when a plant has no means of telling what it is doing nor how well or poorly it is doing it, it is difficult to understand how improvement is possible, even where there is the desire.

Some plants there are whose managements are awakening up to the realization that the boiler room is a business proposition, and the operating reports and data sheets are appearing—the profit and loss account. And so, too, the water meter, the cash register of the coal pile, and other money-saving necessities are coming one by one. But it is slow progress; the inertia of the nation's boiler rooms is extraordinary.

But to cry out that food and fuel will win the war and turn no hand to stop the waste, the colossal waste that is going on so uselessly, so needlessly and so injuriously and so universally—it is that that is so hard to understand. The small plants need help; and they want it, if they only knew. And the country's coal situation requires no less that they be helped. There are democratic as well as autocratic ways of rendering this assistance. To talk of centralized energy generation ultimately to the elimination of the isolated plant is by the way. The central station upon a vast scale and the small isolated plant should not compete. Each has its field, which now overlaps, but the overlapping is disappearing. Much can be done in the large plants in the way of economy but more can be done in the many few plants.

Heat Losses Are Turned to Use.

Not only is greater effort being made toward obtaining more heat from coal, but the indifference about waste of steam is disappearing as the cost of such waste is appreciated more and more. The low-pressure steam-heating load, at once a radical move toward conservation of coal, abatement of smoke and a very profitable load for the utility is being taken up quite enthusiastically by many plants as they realize that exhaust steam may be used for nearly 100 per cent mechanical energy without detracting from its value as the commodity delivered to the heating mains. Along the same lines, and for the same reasons, the use of steam-electric auxiliaries are being chosen with regard to economical heat balance and increased reliability, a practice not long since a monopoly amongst the larger companies.

The more general use of boiler-room instruments and automatic control of fuel and air and mechanical stokers with their ready response from banked fires to several times normal rating are enabling boilers to be operated economically with respect to individual efficiencies at various loads by reducing the banked fire in number and duration, and by varying the ratings of boilers instead of firing up others. Boiler-room instruments and automatic control makes it almost as simple a matter to operate boilers in parallel with pro rata or desired distribution of load as generators because automatic mechanical control is efficient and flexible. Boilers should be taken off and put on in the same way that generators and other electrical apparatus are often controlled by a load dispatcher, according to load and efficiency of individual units. Leaky valves and flanges, and condensation from bare or poorly covered steam pipes are being taken care of. Water meters are being used to show what happens to water heated, and how much comes back, how much is unaccounted for. And so on. It has been claimed quite often that the big things will take care of themselves if the little things are taken care of, and perhaps there is no greater truth than this when applied to the boiler room.

DETAILS OF LINE CONSTRUCTION IN NEW JERSEY.

Experiences of Public Service Company Told Before New York Electrical Society.

Two subjects of timely importance were discussed at the December meeting of the New York Electrical Society. The story of the torpedo was told by Frank M. Leavitt, inventor of the Bliss-Leavitt torpedo, and W. A. La Due of the Public Service Electric Company described the building of an aerial cable line across the Jersey meadows.

The meeting was held on December 20, at the Engineering Societies Building, and was attended by representatives of almost every branch of the electrical industry. Central-station men, electro railway operators, and telephone and telegraph engineers were among those present.

W. A. La Due in his talk on "Aerial Cable Construction," gave an admirable description of the manner in which the Public Service Electric Company of New Jersey successfully overcame the difficulties of running a cable over the Jersey Meadows. These stretches of swamp land are different from the so-called "meadows" in inland states. They are salt marshes, and during some months of the year they are entirely submerged. In summer, the grass, cat-tails and fox-tails grow to a height of fifteen feet, and even during the spring months a pedestrian would sink to his knees in the mire. The only period of the year when one can safely travel on them is in the winter, when they are frozen solid. The line was erected during the worst season of the year, the "rainy" fall. How this arduous task was accomplished was shown in lantern slides, which illustrated the system of pole erection, and the running of the line, all of which was accomplished by means of the steam winch. The poles were hauled over the ground to their destination by attaching them to the endless wire rope, and as they were distributed the rope was used to hoist them by means of the block and fall on the derrick, and also to haul the derrick from one location to another. How the whole undertaking was carried out was graphically shown in motion-pictures.

Mr. Leavitt told many of the little understood points in the construction and operation of the mighty medium of attack which is playing such a prominent part in the present war. When Mr. Leavitt had finished his address, the subject was thrown open to discussion, and so engrossing was the interest shown that far into the evening the lecturer was besieged with questions from the audience, which seemed fully to appreciate the rare opportunity of securing information on a subject of which there is comparatively little popular knowledge.

Some Feature of Special War Lighting

Efficient and Safe Lighting of Munition Plants to Insure Intensified Production—Lighting of Training Camps —Protective and Other Special War Lighting

By GRABLE B. WEBER

IT has been stated that there are three vital elements necessary to bring the war to a successful close—a superior war council, a large army adequately equipped, and sufficient ships. The first is a matter of agreement and selection, the second and third are matters of men, materials, and time. The question of men can be settled; they can be had by proper regulations and training. As to raw materials, these are being produced in sufficient quantities, but the finished product (being a combination of men and raw materials) in order to be produced in time must be subject to a number of vital conditions which have to be improved before the supply can be equal to the demand.

Granted that the raw materials and men are obtainable, the only element to be considered is time. To gain this requires more intensive and more efficient production. All features affecting the manufacturing processes must be perfected so as to facilitate operation without a hitch, and at the same time work must be speeded up to much more than the ordinary rate of production. This means working at high speed day and night. High-speed day work and efficient night work means that all conditions must closely approximate the ideal.

Munition Manufacture Requires Good Lighting.

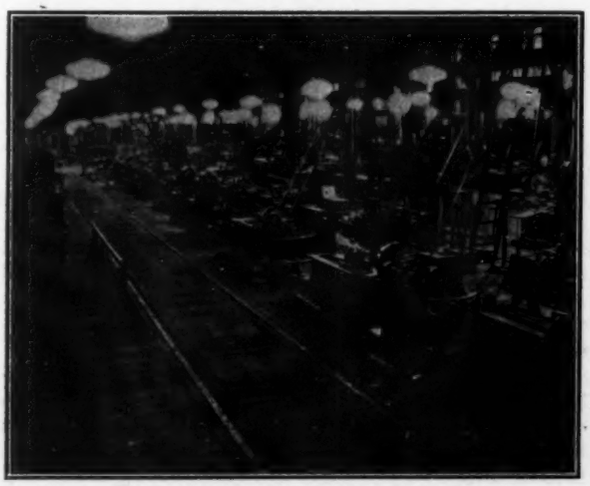
In every operation in the manufacture of war supplies men must use their eyes. Good eyesight is an important factor in winning the war, and good eyesight is useless unless proper illumination is provided for. Working in a poorly lighted locality brings on fatigue and headache at night, with a consequent slowing up affecting even the succeeding day. If the proper illumination is not provided, production is retarded, mistakes are made, material is wasted, disastrous accidents take place and intrigue is fostered. In our daily routine these facts are brought out innumerable times each day.

The manufacturers of war supplies were slow at first to realize the importance of good lighting. One manufacturer, in particular, whose product forms one of the vital needs for the army—ammunition—was forced to investigate the problems of illumination, because of the change in conditions of manufacture. This powder maker had heretofore worked his forces only during the daylight hours, necessitating no artificial illumination. When the war orders began to come in from the allies, before our country's entry into the war, his plants were compelled to work 24 hours a day to keep deliveries going at the proper rate. Fortunately modern efficient lighting equipment made it possible for him to continue production during the dark hours at the same speed as during the daylight hours. There were two conditions, however, which entered into this problem. One was the question of sufficient light, properly directed from the bulb, and the other the question of safety. The first was solved by proper selection of efficient lamp and reflector units.

A powder mill is made up of a number of small buildings, widely separated for protection in case of explosion. The various chemicals and other ingredients which go to make up the explosives are in most instances highly inflammable in themselves, consequently the proper unit including an inclosing globe is necessary to offer protection from the hot filament in case the bulb breaks and from arcs in the sockets or wiring connections themselves. A typical munition plant, a benzol plant in the vicinity of Chicago, could not now be running to its full capacity, were it not that this type of unit could be readily supplied. Benzol in itself is highly explosive and adequate protection must therefore be provided.

Illuminating Training Camps.

Another aspect of the problem of war lighting is shown in the following: On August 1 of last summer



Machine Shop of a Southern Trunk-Line Railroad.

Illumination of Armory of an Infantry Regiment.

Foundry of a Large Agricultural-Implement Works.

Night View in Shipping Room of a Munitions Plant.

orders were given to proceed at once with permanent construction of one of our naval training camps. Prospective sailors had been housed in tents and in makeshift barracks. By the middle of October practically every building was completed, electric lighting plants were in operation and a complete electric lighting system was installed in every building. Without electric light these camps would be desolate spots during these winter months. Special care was used in the lighting of these buildings to shield the eyes of the men from the direct glare of the light. Sufficient illumination was provided to insure cheerfulness among the men. Roadways and grounds were illuminated in such a way as to eliminate any possibility of destruction by outside parties. The heating problem necessitated a continuous stream of trucks traveling from the coal bunkers to the various individual heating plants throughout the camp. These coal bunkers therefore had to be properly and adequately illuminated to permit this constant movement of coal.

Protective and Miscellaneous War Lighting.

Throughout the country, aside from the cry for more production and greater output, the question of protection became important. The insidious propaganda and malicious spy system of our enemies have been so craftily worked out that there is a constant danger to the safety of the war supply manufacturing and shipping establishments. To minimize this danger adequate systems of protective lighting have been provided to illuminate the grounds, fences and the gates of munition plants and government works. These have been illuminated, in fact, almost as brightly as by day, in order to detect and apprehend anyone attacking the plants.

Aside from the large-scale war-lighting problems mentioned above, there are the innumerable applications of electric lighting in various specialized forms, such as several forms of signaling in operations on the seas, searchlights to determine the position of hostile aircraft in air raids, trench lights, etc.

Portland to Continue Bright.—Federal Fuel Administrator Garfield has telegraphed Fred. G. Holmes, Oregon administrator, stating that the general order declaring Thursday and Sunday nights of each week dark, does not apply to hydroelectric districts, but only to places where fuel is necessary in generating plants.

Manhole Cable Classification.

By M. S. Montgomery.

It is customary in underground distribution, whether of alternating or direct current, to designate fuses, services, disconnects and potheads by some form of symbol. The method employed may be numerical, alphabetical, or a combination of both, according to the system in vogue on a definite distributing system. The question with which we are interested here is not what is the best method of identifying cables, fuses, potheads, etc., but how best to make whatever markings are used permanent.

Manholes are at best unfavorable locations. They are dirty, and in dry weather dust covers everything with a coating that rapidly grows so thick as to obliterate surfaces. Moisture is as often present as not, causing decay, chemical action and rapid disintegration. Sewage and illuminating gas and other gases and seepage also tend to obliterate and detroy marking.

Identification is often done by means of stenciling, usually light figures upon a black background. Paint is not well suited to marking underground structures because of the rapidity with which the paint becomes hidden or obliterated or attacked. Aluminum tags or tags of some other metal are again often used, the markings being stamped upon them. But here also the action of moisture, heat and acid and gas within a few years causes havoc.

Perhaps the best manner of identifying underground apparatus is by means of enameled figures or letters, as the case may be. The enamel is not at all susceptible to the action of the acids and gases that haunt underground passages, ducts and manholes of our city streets. Being of an extremely smooth surface, which is not readily eroded, dust and dirt do not readily adhere. Moreover, the smooth enamel surface is easily and quickly cleaned by wiping and will then be in as good a condition as when first installed. And then again such figures or letters are conspicuous, the color of the letter or figure standing out conspicuously from the background.

For best results—permanency, economy and reliability—enameled plates of first-class quality, handled carefully before and during installation to prevent breakage and cracks seem to answer the purpose most satisfactorily.

A Year's Progress in Electrical Safety Work

Results Which Have Been Achieved by the First Year's Trial of the National Electrical Safety Code

By MORTON G. LLOYD,

Associate Electrical Engineer, Bureau of Standards.

ONE of the important developments of the year 1917 in relation to safety work and the prevention of accidents in the electrical field has been the introduction of the National Electrical Safety Code, which was published in finished form in November, 1916, for examination, trial, and constructive criticism. This Code was prepared by the Bureau of Standards after a study, extending over several years, of electrical accidents and their causes, and the means for reducing the hazards connected with electrical work. After its first formulation it was extensively revised and improved through the co-operation of a large number of conferees representing various interests which would be affected by the application of these rules. In this work the Bureau had the co-operation of the various electrical utility companies, including telephone, telegraph, railway, lighting and power companies; public utility commissions, city officials, insurance inspectors, manufacturers, steam railroads, consulting engineers, electrical workers and others. Conferences were held in a score of cities in different parts of the country and every effort made to get the benefit of wide experience and different points of view as influenced by local conditions or by variations in practice in different parts of the country.

The National Electrical Safety Code consists of five parts. There is a preliminary section giving rules covering methods of grounding to be applied where grounding is required by the Code. Part 1 deals with the installation of machinery and other apparatus in central stations and substations. Part 2 gives rules for construction of overhead and underground electrical lines. Part 3 is concerned with the installation of utilization devices and covers wiring appliances, motors, and all other apparatus installed in factories, residences, and other buildings. Part 4 applies to the operation of electrical equipment.

It will be evident that different departments of electrical industry are concerned with different parts of the Code. Electric central stations are concerned with all parts, since Part 3 applies to installations of their customers and the other parts apply to construction and operation of their own properties. Telephone companies are concerned with Parts 2 and 4. Electric railways are concerned with Parts 1, 3 and 4. Manufacturers of different classes of equipment will be concerned with different parts of the Code. Electrical contractors are concerned principally with the installation rules of Part 3, and this will also be true of electrical inspectors. State utilities commissions will

THE PUBLIC UTILITIES COMMISSION OF THE
STATE OF COLORADO
CAPITOL BUILDING
DENVER

June 30, 1917.

To All Electric, Electric Railway, Telephone and
Telegraph Public Utilities:

Your attention is directed to Circular No. 54 which has recently been issued by the Bureau of Standards, covering the National Electrical Safety Code. It is anticipated that at some future time the Public Utilities Commission will, in the interest of safety and uniformity, adopt, either in whole or in part, the rules of the National Bureau of Standards, as contained in this bulletin.

The different utilities affected are respectfully requested to make such study and trial application of this Code in connection with new construction work as will familiarize them with the Code and enable them to ascertain in what respects, if any, the requirements of this Code are inadequate, unreasonable, or impractical.

Utilities finding the requirements of this Code to be unreasonable, inadequate, or impractical should hold themselves in readiness to present the results of their experience to the Commission in detail, and in such form as will enable the Commission to act intelligently upon this Code when it deems it expedient or necessary to do so.

All utilities not now having a copy of the National Electrical Safety Code are requested to procure one from the Superintendent of Documents, Washington, D. C. These may be secured at 20 cents per copy, and will be found to constitute a very comprehensive treatise upon the subject of line construction and electrical construction generally.

Yours very truly,

THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF COLORADO

BY Geo. A. Flannigan,
Secretary.

FJR GM

Order of Colorado Commission.

THE PUBLIC SERVICE COMMISSION
OF WEST VIRGINIA
CHARLESTON

February 28, 1917.

TO ELECTRIC, ELECTRIC RAILWAY AND TELEPHONE UTILITIES:

Dear Sirs:

The Bureau of Standards at Washington, D. C., has prepared a publication, Circular No. 54, covering the National Electrical Safety Code, and a copy of this bulletin is being sent to you by direction of this Commission.

The Public Service Commission anticipates adopting the rules of the National Bureau of Standards as contained in said bulletin as the standard for electrical construction practice in this State, and the different interested utilities are respectfully requested to make such trial application of it in their new construction work as will familiarize them with the Code and enable them to ascertain in what respect, if any, the requirements may be inadequate or unnecessarily severe. It is requested that when such inadequacy or unreasonableness is found, the evidence showing same will be presented by the utility as fully as possible, and that said utility will report to what proportion of construction belonging to the utility such objections will apply.

The Commission will be glad to have any suggestions in regard to this Code and trusts that the utilities will co-operate with it in its efforts to provide a standard for electrical construction.

Very truly yours,

THE PUBLIC SERVICE COMMISSION

BY R. B. Bernheim,
Secretary.

B

Order of West Virginia Commission.

usually not be concerned with Part 3, while industrial and labor commissions may be concerned with all parts of the Code. Casualty insurance companies will certainly be concerned with all parts. The section on grounding will be of interest to any one having to do with any other part of the Code.

Has Been Favorably Received.

The Safety Code has been very favorably received by nearly all of the interests concerned with its application and especially by inspectors and other public officials, insurance companies, state commissions and manufacturers. As development of the Code proceeded most of the interests concerned found that the rules were reasonable, practicable, and adequate. Opposition to the Code, which was at one time very strong in certain sections of the electrical industry, gradually diminished as familiarity with the Code increased and it has now almost entirely disappeared. Claims have sometimes been made that the Code was not practicable, or that it was an undue burden upon certain sections of the industry. Actual application of the Code has shown that such criticism was largely unwarranted, and some of the previous opponents to the introduction of the Code have become warm friends and advocates of it.

The Code takes into consideration differences in climatic conditions in different parts of the country, differences in density of population, and other differences in the condition of hazard which is connected with the construction and operation of overhead lines. This makes it of general and wide-spread application without changes which might otherwise be necessary to meet local conditions. Increased familiarity with the Code generally leads to an appreciation of its adequacy and its reasonableness in meeting the conditions which arise in every-day practice.

Adopted by Utility Companies.

The Safety Code has been applied during the past year by a great many utilities, manufacturers and inspection agencies. Many of the foremost electric light and power companies have found it an excellent guide to good and safe practice and have voluntarily applied it to the construction and operation of their properties. Indeed many of them have found it unnecessary to make any important changes in their previous practice in order to conform to the Code rules. The principal objections which have been raised to the Code have been in connection with Part 2 dealing with overhead line construction. This is due to the fact that the interests of the different utilities are often conflicting in cases of line and railroad crossings and it has been necessary to make reasonable compromise between these conflicting interests, the aim being to avoid putting too onerous burdens upon any one utility and yet making requirements which shall provide construction which is reasonably safe and free from accident hazard. It is generally acknowledged that the National Electrical Safety Code has done this more completely and with more general satisfaction than any of the previously existing rules or specifications for this purpose.

Advantages of the Code.

Another advantage in superseding any local or state rules which have heretofore been applied to a limited extent, is the national uniformity which thereby results. It is a great advantage to utilities whose lines cross state boundaries and to those which are organized under extensive holding companies to have uniform rules applied to their properties in different states. It is also an advantage to manufacturers of equipment which must comply with the rules to have a uniform national standard. There can be no doubt as to the desirability of having a single code of safety requirements applying throughout the entire country, when this code has been prepared with the full co-operation of all interests concerned and has been developed through free discussion and criticism of tentative rules.

Suitable safety standards for electrical practice have been a long recognized need of electrical manufacturers. In the absence of such standards many imperfectly guarded appliances have been put out, and makeshift methods of guarding have resulted from the effort of users to assure safety. The condition is almost equally as bad where standards differ in different jurisdictions and guards complying with some rules fail to meet others. Manufacturers are consequently deeply interested in the general adoption of a single national standard rather than different standards in different localities.

Electrical contractors need a definite guide in their daily work in order that installations shall meet reasonable safety requirements. Without a definite set of rules imposed and enforced by a proper administrative authority, business competition leads to a serious and dangerous neglect of suitable precautions. Only by following a definite code can satisfactory and safe construction be assured in work not covered by detailed specifications, and even where specifications are prepared for a particular piece of work there is always a likelihood that important items may be overlooked unless the specifications are checked by reference to such a compilation as the Safety Code. In preventing fire hazards it has been found simpler and more convenient to specify compliance with the National Electrical (Fire) Code than to write complete individual specifications, and the same will no doubt be found true as regards accident hazards and the National Electrical Safety Code.

The entrance of the United States into the European war was not conducive to the introduction of innovations in construction or operation by the electrial utilities of the country, burdened as many of them were with demands for largely extended service and harassed as they almost universally were by difficulties in obtaining materials and maintaining an adequate and competent staff of operators. Nevertheless, many of the utilities found the Code a helpful guide to good and safe practice and its application an advantage even under such unfavorable conditions.

Attitude of Commissions.

Public utility commissions and other administrative bodies had felt the need of such a code of rules as a guide in their administrative work and many of them had delayed action along these lines until the National Electrical Safety Code was completed and issued. The Bureau advocated only a trial application of the rules during the year following their issuance in finished form and did not favor making their application compulsory until extended experience had been obtained with them. Following this policy the Public Service Commission of West Virginia issued in February, 1917, a bulletin requesting utilities of the state to make a study and trial application of the Code.

Somewhat similar action recommending the use of the Code by utilities was taken during the year by utility commissions in Colorado, Georgia, Nevada and Virginia.

In other states it was found necessary that rules

be formally adopted to control electrical construction and operation, and in Wisconsin the Railroad Commission and the Industrial Commission acting jointly, issued an order consisting of a condensed set of rules which complied fully with the Code and referred to the Code itself for more complete details. In Montana early in the year a code was passed by the Legislature requiring compliance with the National Safety Code in the crossings of electrical supply lines over signal lines and railroad tracks and in other electrical construction not specifically provided for in the statute. The California Industrial Accident Commission adopted certain parts of the Code which apply to the work under its jurisdiction, and similar action was taken by the Pennsylvania Department of Labor and Industry. Other state commissions have been using the Code as a reference standard to which construction must comply in order to meet with approval. This condition exists in Arizona, Illinois, Ohio, the First District of New York, and the District of Columbia.

In the State of Washington, where a statute covering overhead line construction has heretofore been in effect, the Public Service Commission is considering the substitution of the National Electrical Safety Code for the present rules. In a number of other states the adoption of the Code or a recommendation for its use by utilities is under consideration by state commissions.

Used by Insurance Interests.

Early in the year the North Carolina Insurance Department issued a bulletin recommending the use of the Code, and a number of inspection bureaus are using the Code as a reference standard.

The National Workmen's Compensation Service Bureau is using the Code as a reference standard in determining casualty insurance rates for electrical stations and lines. The United States Employees' Compensation Commission has adopted the Code as its electrical standard for the inspection of federal plants. The Code has also been adopted by the safety engineers of the federal navy yards and arsenals.

The International Association of Municipal Electricians at its last convention endorsed the Safety Code for trial use and it is probable that a large number of municipalities will soon introduce the Code as a definite standard of construction which must be met in order to have the approval of their inspectors.

It has been recognized by the educational institutions of the country that the Safety Code represents the application of good practice in the construction and operation of central stations and transmission lines. A number of such institutions have already decided to introduce the Code as one of their works of reference in the electrical engineering course dealing with these subjects. As the Code becomes better known and is more widely applied, this use of the Code will no doubt be taken up in other colleges and its value as a work of reference and as a standard to which future construction must conform will be utilized, and the future engineers of the country will enter upon their work equipped to carry out construction which will be safe and which will lessen the hazards to which both the employees and the general public are exposed through the activities of the electrical industry.

Will be Revised During Year.

It is intended that the National Electrical Safety Code shall be revised from time to time in the light of experience and of developments which may arise through the progress of the industry. The next revision of the Code has been delayed by several circumstances, but may be expected to take place during the forthcoming year. As mentioned above, the entrance of the United States into the war has somewhat interfered with the close study and more extended application of the Code which would otherwise have been given to it. On the other hand, difficulties with the Code and reasons for amendment have not developed to the extent that might have been expected. It seems likely that very little change will be made in most parts of the Code when the next revision takes place, since very few criticisms of it up to the present time have been unfavorable.

Part 2 dealing with overhead line construction will probably be somewhat augmented so as to extend its scope when revision takes place, and in this respect it will be made more complete. Very few changes, however, have so far been found necessary in the substance of its present provisions, but it may be advisable to change the wording of certain rules and possibly also to change the arrangement in order to make it more convenient for reference. Such changes will of course only be made after consultation with the many conferees and committees of the technical and utility associations whose past co-operation has made possible the development of an Electrical Safety Code which has been so satisfactory in its initial form.

Commonwealth Edison Company Merges Its Electric Shops.

With the passing of 1917 passed also the once-famous and first Electric Shop of Chicago. It was in January, 1909, that the Commonwealth Edison Company opened its Electric Shop at Jackson and Michigan Boulevards. It was the first electric shop in Chicago then and it soon earned a national reputation on account of its exquisite fittings, magnificent furnishings and elaborate equipment. With all its luxury, and novelty in that so many useful and ornamental electrical appliances were gathered together to a larger extent than previously employed, it soon became one of Chicago's proud possessions, situated as it was at the intersection of Chicago's aristocratic boulevards, Michigan and Jackson.

Things have moved rapidly since that time, however. The first and perhaps most beautiful electrical store ever in existence, once unique because selling things only electrical, that once had ample space, now finds demands have outgrown its facilities, so the Electric Shop is moving to the later Electric Shop in the Edison Building at Clark and Adams Streets, where more spacious quarters for things electrical will give the wider field greater chance for exhibit.

Byllesby Properties to Assist in Sale of War Savings Certificates.—Application has been made by the bond department of H. M. Byllesby & Company to have the many offices of Byllesby utilities throughout the country appointed special agents for the sale of war savings certificates and thrift stamps. W. H. Clarke, manager of the bond department, says in this connection: "Public service company offices which handle cash and come into intimate contact daily with all classes afford admirable facilities for assisting in this campaign. In the many towns we serve, a large number of people are accustomed to coming to our offices for investments. Thousands have made their patriotic purchases of Liberty bonds through our representatives at the properties as well as notes and preferred stock of our operating companies offered under our customer-ownership plan."

Editorial Comment

Onward

SOME there are who live in the past, looking back upon what they have once accomplished, letting the present, which they could call their own, go by empty of achievement. Others there are who look to the future, hoping, expecting, waiting, waiting for what the future will bring to them—the future that never comes. And there are still others who use today as best they know while pausing to look both backward and forward, realizing that today alone belongs to them and to do with as they will.

It is well to use the present to full purpose. But it is well to pause and in pausing look back in meditation upon the year that is passing, that we may learn what we have actually accomplished, how nearly we have attained the goals we set out to reach, where and why we have fallen short. Out of the past we can profit, for experience comes with the years. And after pausing we can turn our faces toward the future with brave hearts and a spirit of faith and confidence in ourselves for the coming year, strong in the determination to do our best with the opportunity that is ours.

The electrical industry has excelled itself during the year that is passing in ways that have long been known. But it is playing a gigantic part in the prosecution of the war by making possible things not otherwise possible, by conserving men, materials, time and money, and permitting women to do work that otherwise only men could only do. Looking back year after year we cannot help but wonder at the vast strides and wonderful achievements of the electrical industry, the rapidity with which it has grown and the multiplicity of uses to which it has been applied. It is now indispensable in all walks of life, for comfort, for health, economy and convenience, for overcoming difficulties and solving problems. Looking to the future with our knowledge of the past accomplishments and present progress we feel sure in our purpose and enthusiastic for a future rich of promise and full of achievement.

The electrical industry is passing into another year, proud of its history of vast and magnificent endeavor and accomplishment for the good and betterment of mankind, secure in the present with its knowledge of the past. It is out of the past that we stand where we are today. It is from our search into the future that will find us prepared for whatever tomorrow holds. Thus the electrical industry passing once again out of one year into another, each year better than the last, looks to the future with the faith and strength of youth, the security born of success and the knowledge of itself.

The Understanding that Comes of Knowledge

CENTRAL-STATION managers often lament that they are misunderstood, that the public cannot understand the complications and intricacies of electricity supply, that progress and development are being hindered because of entire ignorance of technicalities by the masses. This is true—and yet what steps are the central-station managers taking to remove this barrier of ignorance, or perhaps unfamiliarity would be a better word, that stands between the manufacturer and purveyor of electricity and the user? With extremely few exceptions nothing is being done, in fact the central-station managers have found condolence in their lament.

This is an age of publicity. The manufacturer tells his clients of his wares and how they accomplish their purpose. The Government tells the people why they must do this and that and how best to do it, how by co-operation they may help themselves, their community and the nation. It is with knowledge that understanding comes. It is ignorance that breeds suspicion and fear.

The policy of frankness has been carried out almost universally by business houses, communities and societies, because they have found that it pays. The central-station companies in general have adopted a policy of publicity quite widely on certain topics and mostly at definite times as when franchises and rate changes are under advisement. It seems, however, that the utilities in striving for that co-operation so often discussed and universally approved might with advantage to themselves and the public carry on a wider and more deliberate policy of publicity and education upon the subject of electricity supply.

Electric service is today the motto of most utilities who advertise the use of electricity as a time, a money, and labor saver, as the one simple method of increasing production, safety and comfort. But they do not explain what this service exemplifies, its intricacies and the expense such service involves. Service it is that is responsible for certain charges superposed upon energy charges, but when the public questions its bills it is told rates and their theory are complicated things requiring the talents of lawyers and engineers for their understanding. Many companies capitalize service, and all that readiness to serve represents. But they do not tell what service means and how it is made possible. Co-operation is now commonly asked for, for mutual advantage, but how best may we co-operate without knowing the whys and wherefores?

The public gladly pays for service in hotels, thea-

ters, in fact everywhere where it understands what it is, where it is able to see it and know what it is that is paid for. The one most conspicuous instance that comes to mind where the extent and degree of service rendered is not understood, where it is almost invisible, and where co-operation is impossible without understanding is in the public utility electrical supply. Yet while such service is so often mentioned, so often exploited, and capitalized, it is rarely explained. The public would willingly pay more, and less complainingly, for electric service if the utilities would only tell much more about it. And by so doing the utilities would gain enormously by the actual co-operation of the public, which they claim to crave but fail to make possible.

The mysteries of medicine, of hygienics, engineering and science with which they have long been shrouded in the lay mind are surely being eliminated. Publicity is finding its way into places too long considered sacred to a favored few. And it is well that it should be so, for by so doing everyone gains by understanding, the understanding that comes of knowledge. But the mysteries of electricity supply still remain, to cause fear, suspicion and lack of utilization amongst those whom the utilities ask to co-operate with them. How can the public co-operate when it knows not how, when using something it does not understand, something it almost fears?

The ELECTRICAL REVIEW believes that the utilities would profit vastly by a campaign of education carried on wisely with a definite goal in view. Education as to use of electricty, how it is made, how distributed, how used would give the user some idea of what electricity is, why electric light bills vary from time to time, why rates include more than one item. How many consumers know, or have easy means of determining what electricity does, how it is made and anything about it? What percentage of the public knows what a kilowatt-hour is or how it is calculated? Knowing nothing about electricity, how can it co-operate in doing something it knows nothing about? If the public knew something about matters electrical many of the troubles of the troublemen would disappear; dangers, fears and delays of a certain type would cease; electricity would be used more than it is, perhaps as much as it deserves to be.

The utilities issue booklets telling of profit and loss, of economizing time and effort and money in the home, the factory and elsewhere. Let them tell the masses something about electricity, its use and abuse. Familiarity comes with understanding; understanding comes only after knowledge. And with understanding will come co-operation, and increased use and greater number of applications of electricity.

Turn on the light upon electricity, its production and application in a way that the public can learn, and in learning enjoy it. Remove the mysteries and secrecy with which electricity is enshrouded. By leaflets, booklets or wall cards distributed with bills, with service applications or in each case as seems best.

To plead for co-operation without telling how co-operation is possible is not efficient. To ask the masses to use electricity and not explain something about it is hardly cumulative for best results. Electricity, the universal servant, must be understood and appreciated to be used universally. The day has gone when electricity should be enshrouded in mystery. The time should be past when utility managers bemoan inability of the public to understand. The public is ever ready to learn, and is an apt pupil at that. Surely it behooves the utility managers to teach the public, that all may profit from the understanding that comes of knowledge.

The Problem of the Jobbers

IN THIS period of conservation it is most appropriate that some study should be made of the waste of labor and money in the placing of orders on the part of electrical dealers and retailers and the filling of same by the wholesalers. For instance, it is not generally known that approximately 55 per cent of the orders received by electrical jobbers are for less than $10; or that the average cost of handling an order of less than $10 is $3.93. As a matter of fact, the routine of handling small orders must of necessity be identical with the larger ones, the only difference in expense being the little additional time necessary to assemble and pack. It is apparent, therefore, that in filling many small orders the expense to the jobber equals or exceeds the amount received for the goods and this naturally means a considerable loss in the aggregate.

Considered from the standpoint of the dealer, or retailer, it is necessary for him to give individual attention to every one of these small purchases. He has the expense of bookkeeping and of the handling of the invoices, and his extra expense for making purchases in small quantities is in proportion to the expense of the jobber.

The dealer can easily remedy these conditions by anticipating his requirements to some extent, or if that is impossible, by holding the small orders until they aggregate a sufficient number to make the transaction worth while to the jobber. It must be remembered that jobbers are wholesale and must sell in wholesale quantities in order to give the service which is expected of them. On the other hand, dealers can improve their service to their customers by maintaining a sufficient stock, particularly in these times of heavy demands and advancing prices.

A study of this question will clearly show, therefore, that it is to the interest of the dealer, as much as it is to the jobber to remedy these conditions. The jobbers through their organizations and individually are appealing to the dealers for their co-operation. The cause is a worthy one and electrical dealers should realize that in helping the jobbers they are helping themselves.

Week's Events

Chicago Fuse Company to Make Renewable Fuses—Niagara Falls and Pittsburgh Power Under Government Control

CHICAGO FUSE MANUFACTURING COMPANY TO MAKE RENEWABLE FUSES.

Multi Refillable Fuses to Be Manufactured Under "Union" Trade-Mark.

The Chicago Fuse Manufacturing Company, Chicago, Ill., manufacturer of the "Union" line of electrical protecting materials and conduit fittings, has secured the exclusive right to manufacture the Multi-refillable fuse, under patents owned and controlled by the Multi Refillable Fuse Company, Chicago. The transaction also includes the good will and trade-marks, as well as the merchandise and machinery required in the production of this fuse, which will hereafter be known as the "Union" renewable fuse.

In announcing this consolidation, the Chicago Fuse Manufacturing Company states:

"In making this advanced step we wish the trade to understand that we will continue the manufacture of the well-known line of "Union" non-renewable cartridge fuses, and with our added facilities we can confidently assure the trade that we will be able to not only give more adequate service, but also supply the definite type of fuse which is best suited to the individual requirements.

"It cannot be denied that in many circuits overloads are so infrequent as to make it uneconomical to install a renewable fuse with a high initial cost. On the other hand, where the line is often overloaded, causing numerous fuse replacements, it is without question better to install the renewable type. The wise buyer will determine for himself which type of fuse is most economical for his purpose. In either event, we are prepared to supply the fuse best adapted to meet the particular condition."

ELECTRICAL WAR SERVICE WORK.

Summary of Co-operative Movement Among Electrical Manufacturers—Committees Appointed.

The ELECTRICAL REVIEW has recorded on several occasions the splendid war service that has been rendered to the Government by the members of the Associated Manufacturers of Electrical Supplies. This work has entered into all branches of the industry and has been of the greatest help in securing supplies needed promptly and in quantities desired.

An important meeting was held in New York on December 13, which was presided over by H. B. Crouse, president of the Associated Manufacturers of Electrical Supplies and which was attended by representatives of that association, the Electrical Manufacturers' Club and the Electric Power Club. This meeting was held at Delmonico's as previously noted in the ELECTRICAL REVIEW, and was quite largely attended by leading electrical manufacturers.

At this meeting, R. K. Sheppard sketched briefly and concisely the line of carefully organized co-operative work by which the manufacturers of this country are now linked together to assist the Government in meeting the problems before it. This begins with the Council of National Defense, then the War Industries Board and committees of that board, the divisions of which are seven in number.

The Priorities Boards of the Army and Navy both have representatives acting individually for the benefit of the Army and Navy, but sitting in consultation with the Priorities Board. The Finished Products Section, which interests the electrical manufacturer most, has its special committee on supplies under the Production Committee—small tools and machines, machine guns and electrical equipment—which is a committee only recently established and now getting officially to work.

Finally comes the Clearance Committee, which sits in Washington every day, with its various departments. The chairman of the Electrical Equipment Department of this committee is Walter Robbins, of the Wagner Electric Manufacturing Company.

Mr. Sheppard concluded by saying: "The object of this General War Committee of the electrical manufacturing industry is to make a connecting link between this tremendous force that is gaining headway in Washington and the industry you represent."

The most recent and important step in the work occurred at a meeting of chairmen of the War Service Committees of the Sections, in conference with R. K. Sheppard and J. R. McKee, on December 19, at the offices of the Associated Manufacturers of Electrical Supplies, of which Charles E. Dustin is the secretary. This supplemented the meeting at Delmonico's the preceding week.

A general and vigorous speeding up of the work of the individual committees was one of the objects of the meeting. Mr. Sheppard brought out the following facts in his opening remarks: "Just as far as it is possible, the Electrical Equipment Committee needs the endorsement, the upholding and the backing of the industry. If it can accomplish all that it has in hand it will be a great time saver for every one of the manufacturers, because it will introduce one connection that will take care of the different divisions of the Government in Washington. . . . It is desirable that for the present anything you gentlemen may have in your industries that you perhaps want to discuss with the Electrical Committee, should be carried to the Electrical Committee through the General War Service Committee."

A further interesting statement of Mr. Sheppard was to this affect: "The thing you gentlemen really want to know is not the producing capacity of your fellow men's plants, but the available capacity, when and as needed. It is of no use burdening your groups of manufacturers by keeping them sending you statistics on total capacity or even today's available capacity, unless you have need for it. But you do so want to organize in your committee that when it be-

comes a question of what your branch can do in the way of supplying a million parts of any kind that you know how to go at it."

The War Service Committee of the various groups of the Associated Manufacturers of Electrical Supplies, which were appointed as the outcome of this meeting, are as follows:

PERSONNEL OF WAR COMMITTEES.

Metallic Flexible Conduit and Armored Conductor Group.—F. W. Hall, chairman, Sprague Electric Works, New York City; V. C. Gilpin, Triangle Conduit Company, Brooklyn, N. Y.; G. F. Holly, Youngstown Sheet & Tube Company, Youngstown, Ohio.

Non-Metallic Flexible Conduit Group.—W. H. Thornley, chairman, Tubular Woven Fabric Company, Pawtucket, R. I.; D. H. Murphy, American Conduit Manufacturing Company, Pittsburgh, Pa.; Russell Dart, Alphaduct Company, Jersey City, N. J.

Rigid Conduit Group.—D. H. Murphy, chairman, American Conduit Manufacturing Company, Pittsburgh, Pa.; F. C. Hodkinson, Safety Armorite Conduit Company, Pittsburgh, Pa.; J. S. Patterson Enameled Metals Company, Pittsburgh, Pa.

Metal Molding Group.—C. E. Corrigan, chairman, National Metal Molding Company, Pittsburgh, Pa.; D. H. Murphy, American Conduit Manufacturing Company, Pittsburgh, Pa.

Line Material Group.—H. G. Lewis, chairman, Electric Service Supplies Company, Philadelphia, Pa.; J. W. Perry, H. W. Johns-Manville Company, New York City; A. L. Johnston, Electric Railway Equipment Company, Cincinnati, Ohio.

Carbon Group.—J. F. Kerlin, chairman, National Carbon Company, Inc., Cleveland, Ohio; G. P. Fryling, Speer Carbon Company, St. Mary's, Pa.

Molded or Formed Insulation Group.—R. W. Seabury, chairman, Boonton Rubber Manufacturing Company, Boonton, N. J.; E. B. Hatch, Johns-Pratt Company, Hartford, Conn.; Joseph Rockhill, General Insulate Company, Brooklyn, N. Y.; B. H. Howell, Garfield Manufacturing Company, Garfield, N. J.

Panelboard and Switchboard Group.—Charles L. Eidlitz, chairman, Metropolitan Electric Manufacturing Company, New York City; H. F. Krantz, Krantz Manufacturing Company, Brooklyn, N. Y.; W. T. Pringle, Pringle Electrical Manufacturing Company, Philadelphia, Pa.; F. T. Wheeler, Trumbull Electrical Manufacturing Company, Plainville, Conn.

Porcelain Group.—H. R. Holmes, chairman, R. Thomas & Sons Company, East Liverpool, Ohio; B. B. Dinsmore, Imperial Porcelain Works, Trenton, N. J.; G. W. Kettron, Illinois Electric Porcelain Company, Macomb, Ill.

Outlet Box Group.—H. D. Betts, chairman, Thomas & Betts Company, New York City; A. I. Appleton, Appleton Electric Company, Chicago, Ill.; H. G. Knoderer, National Metal Molding Company, Ambridge, Pa.

Fan Motor Group.—W. W. Mumma, chairman, Robbins & Myers Company, Springfield, Ohio; A. D. Fishel, Adams-Bagnall Electric Company, Cleveland, Ohio; M. C. Morrow, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

Insulating Materials Group.—J. B. Adams, chairman, Irvington Varnish & Insulator Company, Irvington, N. J.; W. R. Williams, General Electric Company, Schenectady, N. Y.; F. Y. Stewart, U. S. Rubber Company, New York City.

Wiring Devices Group.—J. C. Dallam, chairman, General Electric Company, Schenectady, N. Y. Attachment Plug Section—H. W. Bliven, Harvey Hubbell, Inc., New York City. Fuse and Cutout Section—J. W. Perry, H. W. Johns-Manville Company, New York City. Knife Switch Section—J. H. Trumbull, Trumbull Electrical Manufacturing Company, Plainville, Conn. Snap Switch Section—Shiras Morris, Hart & Hegeman Manufacturing Company, Hartford, Conn. Socket and Receptacle Section—F. V. Burton, Bryant Electric Company, Bridgeport, Conn.

Industrial and Street Lighting Fixture Group.—H. W. Bliven, chairman, Harvey Hubbell, Inc., New York City; A. D. Fishel, Adams-Bagnall Electric Company, Cleveland, Ohio; D. K. Chadbourne, George Cutter Company, New York City.

Interior Lighting Fixture Group.—Herman Plaut, chairman, L. Plaut & Company, New York City; F. W. Wakefield, F. W. Wakefield Brass Company, Vermilion, Ohio; Albert Ullman, Scott-Ullman Company, Cleveland, Ohio.

Wire and Cable Group.—LeRoy Clark, chairman, Safety Insulated Wire & Cable Company, New York City; Edward Sawyer, Atlantic Insulated Wire & Cable Company, New York City; Wallace S. Clark, General Electric Company, Schenectady, N. Y.

SCIENCE MAKING IMPORTANT CONTRIBUTIONS TO SUCCESS OF WAR.

Major Millikan Convinces Chicago Electrical Men that Scientific Research Finds Immediate Application in Meeting War Problems.

The country's scientists and the national, educational and commercial research laboratories throughout the country are making most vital contributions to winning the war. Unostentatiously but steadily they are giving to the Government the fruits of what formerly seemed abstruse and academic studies and these are being applied daily in solving some of the most difficult problems brought up by the war. These interesting facts were brought out in a paper by Major Robert A. Millikan, vice-chairman of the National Research Council, presented before a joint meeting of Electric Club-Jovian League, the Chicago Section of the American Institute of Electrical Engineers, and the Electrical Section, Western Society of Engineers, held at Chicago on December 27. Major Millikan had been called back to Washington, so his paper was read by Professor Lemon, of the University of Chicago, at which institution Dr. Millikan in civil life is professor of physics. The paper was entitled "The Relation of Science and Engineering to the War." The importance of numerous non-fighting activities was shown by the statement that war is 85 per cent science and engineering and 15 per cent actual fighting. For this reason it is especially important that education and research should be carried on as nearly as possible without reduced effort. Men should remain at their normal occupations carrying on needful work until they are called upon for service in lines of more immediate importance. Conduct of the war involves huge problems of organization, engineering and administration. It is an immense task to get the various activities properly under way. The time of the officials at Washington has been largely spent in answering laudable but wasteful personal offers of service. The big problem has been to find big men for the jobs, not big jobs for the men. It is interesting to note that for many of the big jobs it has been found that broad-gauged academic men are better than the average business men, the best example being President Wilson.

One of the most urgent problems of the country is to suppress the intense individualism to the general good through united action. Everything tending to low efficiency, such as the liquor evil, must be eliminated. The future of America is linked up with the way we stimulate and carry out both pure, scientific and commercial research. The progress of the war emphasized this fact and necessitated an immediate and effective co-ordination of research activities. The National Academy of Sciences was called upon to aid in this matter, with the result that the National Research Council was formed. It consists of about 65 men divided into numerous committees. The Council is now being reorganized into some six or eight principal divisions. Its work is carried on for making the country's actual conduct of the war as effective as science can make it so as to shorten the duration of the conflict and its sacrifice of lives. Full co-operation exists between the various government, university and commercial research laboratory organizations.

As early as last March, before we actually entered the war, the committees of the Council were assigned various war problems for immediate investigation. Co-operation with the British and French research authorities has helped greatly and put forward most of this work about two months. Among the many problems given special study were submarine detection, warding off of gas attacks, and locating of big guns by sound waves, which has been done so accurately that guns were spotted within 50 feet at a range of six miles. Major Millikan cited numerous other scientific problems that had been investigated and solved satisfactorily. About 50 per cent of the country's foremost chemists are in war service. There are thousands of physicists at work with the armies on the western front. General Pershing has called for 1000 meteorologists to make weather observations. Many geologists are actively employed in advising as to mining and tunneling operations, etc. Biologists are aiding the commissary, medical and sanitary authorities. Psychologists are helping select officers, aviators and other army personnel so as to make for the highest efficiency and least waste of time, effort and money. Even anthropologists have been able to assist the country in its time of need. Major Millikan hoped that the chasm formerly existing between pure science and applied science—engineering—will be closed as one of the results of the war, which has clearly shown that practically every development of pure science can be made of immediate application for the nation's benefit.

GOVERNMENT CONTROLS PITTSBURGH AND NIAGARA FALLS POWER.

War Industries Board Undertakes to Curtail Power for Non-Essential Industries in Order That War Needs May Not Suffer.

The War Industries Board on December 28 requisitioned all the power being produced on the American side of Niagara Falls to assure an adequate supply of electricity for factories in the Buffalo and Niagara Falls districts engaged in war work. Existing contracts will not be disturbed, it was officially stated, and the "relatively less essential" industries whose electricity is curtailed probably will be able to obtain energy produced by other than hydraulic power. There will be no curtailment in power being furnished public utilities from the Niagara plants, it was announced.

A similar order previously issued at Pittsburgh provides that no electric power shall be transmitted to the "non-essential" industries, except from the surplus power remaining after a full supply has been assured for industries essential to the conduct of the war. Exactly what industries are now considered "non-essential," the board declines to make known. The list, in any event, is said to be a short one. It is also a variable classification, subject to revision in harmony with new aspects of the Government's requirements. The curtailment of electric power will be comparatively small so far as it affects the individual plants at Pittsburgh. Increased production of power, on the one hand, and increased economy in the use of the current, on the other hand, will unite to diminish any necessary loss.

Representatives of the Priorities Committee of the Board held discussions with the manufacturers and with officers of the electric power companies before determining a program. Certificates were finally issued to those factories engaged directly in war work and also to other concerns whose product was considered indirectly vital to the conduct of the war. Presentation of the certificates will obtain from the power company interested a normal share of elecricity. Factories lacking the certificates must make the best arrangements possible.

Seeking to avoid any needless disturbance of business and any hard-and-fast rulings, the Board expresses an earnest hope that manufacturers throughout the country will take warning from these developments and promptly initiate efforts to employ all electric, steam or water power with the greatest possible degree of economy and effectiveness.

In the case at Niagara Falls, a delicate factor was the natural desire of Canada to retain for her own war industries the power that the Canadian plants at the Falls are sending across the line to American factories. The international arrangements has remained undisturbed so far only because the Canadian Government has considerately refrained from checking the war work in which the American factories have been engaged.

Up to the present no serious shortage of power has been reported the War Industries Board as existing in any other industrial center aside from Pittsburgh and the Nigara Falls district.

WORK OF THE COUNCIL OF NATIONAL DEFENSE.

Summary of Activities Affecting Electrical and Allied Industries.

A report of the Council of National Defense just made public covers the history of the Council from its inception to the close of the fiscal year ending June 30, 1917. Permanent organization of the Council was not effected until March 3, 1917.

"In a broad sense," Director W. S. Gifford says in introduction, "the Council and Commission have sought to make available to the United States the best thought and effort of American industrial and professional life for the successful prosecution of the war. It has become a truism that no past war has been so essentially a war of the mechanic and the machine, and it is the realization of this truth that has been throughout the inspiration of the policy pursued by the Council, the Commission, and their subordinate bodies.

"The direction of the machinery of American in-

dustry for the national defense necessarily involves the creation of an organization of great flexibility. The swift changes in strategy and rapid improvement in war machinery, attended by the equal-speed with which implements of warfare are scrapped and replaced at the front has been reflected by corresponding rapid transformation, and stimulation of the industrial organization within the nations at war. These ever changing developments have necessitated almostun - precedented flexibility in Government organizations.

The several fields covered by the Council's work are enumerated as follows:

(1) Supervising co-ordination of purchases for the executive departments of the Government, including the development of new sources of supply for both raw materials and finished products.

(2) The standardization of specifications for tools and implements used in the manufacture of munitions.

(3) The co-operative organization of transportation and electric communication for war service.

(4) The inauguration with the Government departments of an air-craft program and assistance in rendering this program on industrial possibility.

(5) The organization for war of the medical profession.

(6) The conduct of a campaign to assist commercial business in meeting the demands made upon it by the war, and aiding establishments to make available for the needs of the Government men, supplies, and equipments without impairing the essential service of trade and without unnecessary hardship to the people at large.

(7) The development and stimulation of motor transportation facilities for government use.

(8) The organization for common counsel of the leaders of the American labor movement, joined with representative employers and persons prominent in civic and industrial life, for the effective enlistment of the labor forces of the country for the conduct of the war.

(9) The bringing together and concentration on war work of the engineering and educational profession, including the promotion of scientific research for the benefit of the national defense.

(10) Effective centralization and direction of the efforts of American women on assistance in the conduct of the war.

(11) The organization of the coal industry for more effective production and distribution of fuel.

(12) The centralized direction of the activities of the several States in their effort to aid in war.

Committee on Coal Production.

It was the function of the Committee on Coal Production to make every possible effort to increase the output of coal at the mines and accelerate the movement of coal to points where the need was greatest.

Among the methods employed by the committee to relieve congestion and speed up distribution were the pooling of coal of similar characteristics through the Great Lakes ports and through the tide water region.

"During the week ending January 6, 1917," the report states, "the average daily production of bituminous coal was 1,840,000 net tons, of anthracite coal 228,490 gross tons; during the week ending April 21, 1917, the time of the creation of the Committee on Coal Production, the average daily production of bituminous coal had decreased to 1,682,000 tons, of the anthracite 223,680 gross tons. From the latter date production progressively increased until early in July bituminous coal was being produced at the rate of 1,902,864 tons per day and anthracite at the rate of 281,960 gross tons per day, the greatest output of both bituminous and anthracite coal in the entire history of the coal industry, an output, if maintained sufficient to supply not only the entire coal requirements of this country, but also would have created a large surplus to relieve the coal shortage of the allied nations."

Wire Communication.

The report of the Committee on Telegraphs and Telephone includes mention of the following activities of the telephone and telegraph companies in organizing for war service, general preferential consideration given to Government business throughout all the main wire systems, the organization of 14 or more battalions of officers and men for the Signal Corps, increase in plants in all strategic centers of the country in spite of a greatly increased pressure of ordinary civilian business, assistance in training telegraphers and telephone operators for Government work in the field or in Government offices, research in investigation on special communication problems by telephone engineers in co-operation with the war and navy departments.

Committee on Supplies.

By the securing of options the "pegging" of prices of various articles, the allotment of large requirements throughout the industries, the elimination of middlemen, and the curbing of competition between Government departments, the committee has enabled the Government to make substantial savings in its purchases. Its work has principally been concerned in commodities involving unusual difficulties, either because of the large quantity required or the shortage of materials involved in their manufacture, or in some cases, because of an unusual competitive demand for similar articles for civilian use.

Committee on Raw Materials, Minerals and Metals.

The report states: "Without authority to fix prices, the committee has succeeded in obtaining raw materials at substantial price reduction without trade disturbance of real consequence. Without legal power to determine priority, it has been largely instrumental in many cases in diverting output in such manner as to secure the greatest general benefit. Without any power save that of persuasion, it has brought specialized private business efficiency into immediate and effective co-operation with a well-ordered federal system.

The report reviews the appointment of special advisory committees on the several kinds of raw materials, mentioning the purchase through the committee of 45,000,000 pounds of copper at 16⅔ cents at a time when the market price was about 35 cents, and the similar arrangements on steel, zinc and lead. Directly, and through representation on the General Munitions Board, the committee served as a medium of clearance between producer and consumer—the Government, the allies and private industry. It devoted much time to the consideration of price fixing.

New Shipbuilding Plant at Philadelphia.—Work is to be rushed on a large shipbuilding plant on Hog Island, near Philadelphia, Pa. The design and construction supervision will be by the Stone & Webster Engineering Corporation. Much electrical equipment will be installed.

New Appliances

Pull-Socket Current Tap—Weatherproof Receptacles—High-Tension Series Relay—Locking Sockets for Reflector Units

Hubbell Pull-Socket Current Tap.

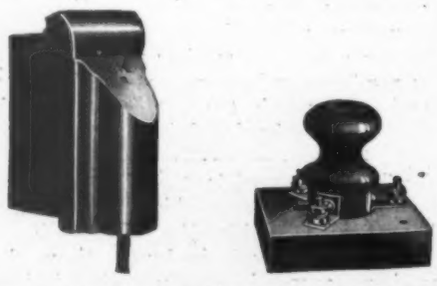
In many cases it is desirable to connect an electrical appliance to a single-lamp wall bracket or ceiling fixture without interfering with the lamp. A very convenient way for doing this has been provided by means of the pull-socket current tap developed by Harvey Hubbell, Inc., Bridgeport, Conn. As shown in the accompanying illustration, this is a combination pull socket and plug receptacle built into the single compact body. It can also be supplied with a ⅛, ¼, ⅜-inch or pendent cap. The pull chain controls the current to the lamp socket proper, whereas the terminals of the receptacle in the side of the body are continuously in circuit. This side receptacle is of standard Hubbell type.

Hubbell Pull-Socket Current Tap.

An advantage that this type of socket gives is that it eliminates the annoyance of the long cord running from side-wall outlets. By means of the new fitting current can be supplied directly below the fixture to operate various table appliances or other portable devices, such as are in general use, without sacrificing the use of light from the lamp itself. It thus eliminates the annoyance of groping about in the dark while trying to plug into the socket.

New Weatherproof Receptacles, Plugs and Boxes.

A new heavy service receptacle mounted in a neatly finished cast-iron box was recently placed on the market by the V. V. Fittings Company, Philadelphia, Pa. The box is weatherproof and arranged with a gravity closing lid which remains closed whether the plug is in or out. The receptacle is made of heavy slate thoroughly insulated from the box. The receptacle sets at an angle in order to permit an easy connection and disconnection of the plug. The binding posts for connecting wires are easily accessible and plenty of room is allowed for wiring. The plug is made of wood so as to stand rough handling and is arranged so that the polarity cannot be reversed.

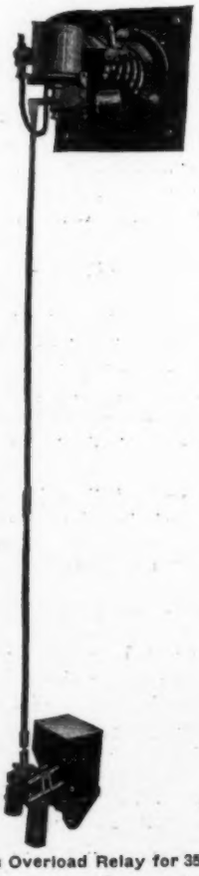


New Type R Weatherproof Box and Three-Pole Receptacle with Plug.

The complete type R outfit is made in two, three and four-pole types for 30 and 60-ampere capacities. It is made especially for outdoor work for use with portable motors, coal hoists, boat-loading machinery in shipyards, for moving-picture-machine outlets, etc.

A High-Voltage Series Relay.

The General Electric Company has recently made several improvements in its high-voltage series relay used for the automatic tripping of oil circuit-breakers.



Inverse Time Series Overload Relay for 35,000 Volts, 100 Amperes.

As illustrated, the mechanism of the relay consists of two main elements joined by a wooden rod.

The upper element, including a solenoid, counterbalancing weight and a mechanism for transmitting the motion of the solenoid plunger to the operating

rod, is mounted on a high-tension insulator and isolated from ground. The lower element, comprising the relay contacts, cover for contacts, calibrating parts, and time-limit arrangement when used, is mounted below the upper element so as to be controlled by the latter.

The solenoid is connected in series with the circuit and one end of the coil is electrically connected to the solenoid frame to avoid static stresses. The solenoid coil and mechanism do not require adjustment after installation and thus are not a source of danger to the attendants.

When the solenoid or relay operates, the motion of the plunger is transmitted through the wooden operating rod to a set of double-break lever-switch contacts which close when the solenoid plunger rises because of overload or short-circuit and open again by the weight of the plunger when these abnormal conditions are removed.

The oil circuit-breaker tripping circuits are the same as when the more common secondary relays are used with circuit-closing contacts.

Current adjustments and the time-delay setting are made at the lower end of the operating rod, and of course in safety to the operators. The relay is calibrated from normal to three times normal current. Current calibration is made by the sliding weight. Time-delay adjustment is made by an oil dashpot shown. When instantaneous operation of the relay is desired, the time-delay features are omitted.

Contacts, mechanism and solenoids are the same for all voltages, that is from 15,000 upward, but the coils vary in capacity according to the normal ampere capacity of the line. The insulators for mounting the solenoid will vary according to the line voltage and the factor of safety required.

This relay is used mostly when the cost of high-potential current transformers for tripping purposes is prohibitive.

Steel Reflector Units with Locking Sockets.

One of the latest developments in the line of steel reflector fixtures is the provision of Maxolite lighting units with locking sockets to prevent the removal of incandescent lamps by unauthorized persons. Somewhat more space is required for operation than is available in the standard reflector. The accompanying illustrations show the method of using these locking sockets.

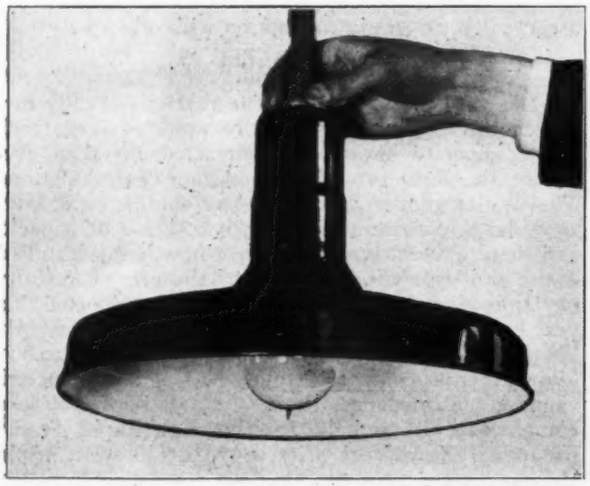


Fig. 1.—Loosening Locknut to Raise Maxolite Reflector.

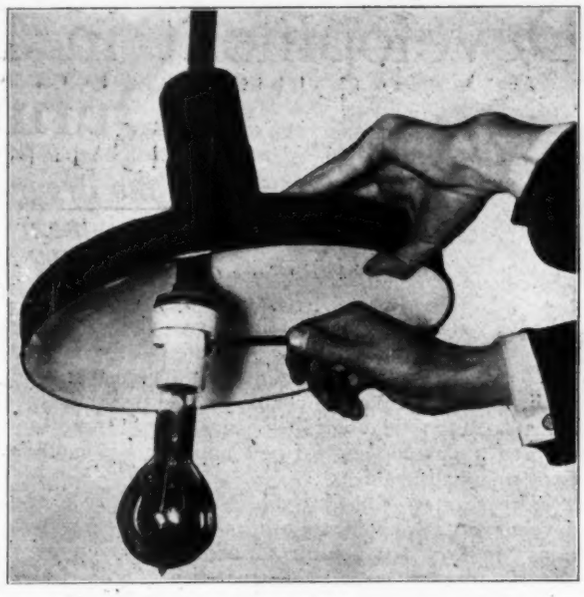


Fig. 2.—Reflector Raised and Locking Key Applied.

Fig. 1 shows the locknut at the top of the type R fitting, the loosening of which permits the reflector to be raised upon the stem. Fig. 2 shows the reflector raised upon the stem and the key applied. Fig. 3 shows the reflector resting upon the key while the lamp is being changed.

A noteworthy feature of this development is that from a distance no one will readily recognize the device as having a locking socket. In case an attempt is made to remove the lamp, it will rotate without backing out. This is preferable to a device which locks the lamp rigidly in place, in which case any one trying to remove the lamp by force might break the bulb, resulting in possible injury to a marauder or innocent employe.

This new Maxolite combination unit is being marketed by the Central Electric Company, Chicago, Ill.

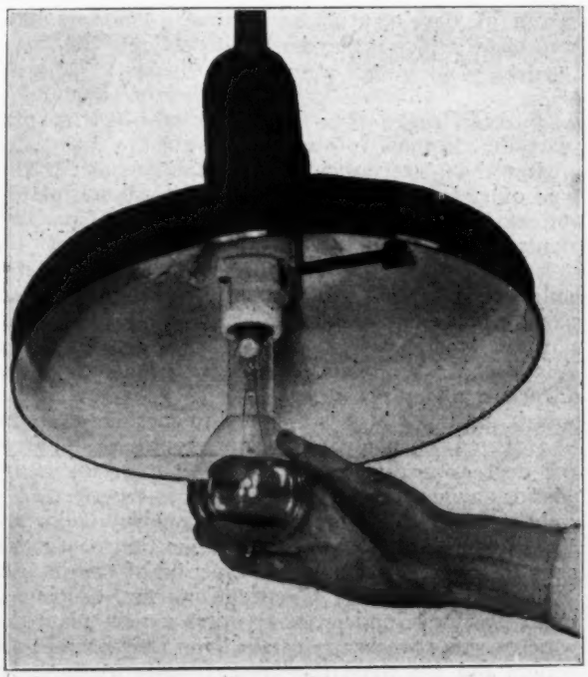


Fig. 3.—Reflector Resting on Key While Lamp Is Changed.

Development in Electrical Apparatus During 1917

A Review of the Progress in Electrical and Related Mechanical Equipment as Prepared by the Westinghouse Electric & Manufacturing Company

A REVIEW of the developments along electrical lines during the past year reveals the fact that the unprecedented demand for apparatus and appliances has called for abnormal efforts to speed up production, leaving little time or energy to be devoted to development of new apparatus or modifications of existing lines.

The year 1917 has brought to the fore no unusual development work in apparatus used by central stations—in fact, the volume of orders received by the manufacturers has so congested their works that development work has almost been eliminated. The year has been one of "wheel horse" effort, bringing through to completion, for example, most of the large turbine generators and water-wheel generators ordered in 1916, which represented in size and economies a distinct advance over anything before attempted. Likewise, in the case of transformers, while there was advance in connection with large-capacity designs for the highest voltages, there were no orders placed for units of exceptional capacities.

It would seem as though the purchasers and manufacturers had put their minds together in an endeavor to secure maximum output rather than singularity or peculiarity of design, realizing that adherence to more closely established designs would facilitate not only the volume of production, but the delivery of individual apparatus, which was of paramount importance for the steadily mounting volume of business, which, in too many cases, could be only inadequately served by existing facilities. The year, however, has not been barren of developments, and some extensions have been made, which it may be well to review.

Stokers.

Forced-Draft Underfeed Stokers.—In the past year, the demand for underfeed stokers has been greater than was anticipated. The demand for this type of stoker came from new central-station plants, and extensions to these plants, and also from old plants requiring increased capacity. Most of the stokers for the former were used with relatively large boiler units. The 1200 and 1400-horsepower boilers seem to be quite popular sizes.

The American Gas & Electric Company, at its Windsor, W. Va., plant, has partly installed, and has on order, underfeed stokers for 16 1262-horsepower boilers, each of which is designed to cause an evaporation of 100,000 pounds of water, continuously, from 100 degrees feed-water temperature, to steam at 250 pounds gauge pressure and 250 degrees superheat. The stokers are also designed to be capable, under the above conditions, to cause an evaporation of 120,000 pounds of water per hour for a period of two hours.

The Union Gas & Electric Company, Cincinnati, Ohio, has now under construction a new plant for which stokers are being installed for 1262-horsepower boilers and for about the same capacity as those for the American Gas & Electric Company.

The Edison Electric Illuminating Company, of Boston, is installing an addition to L-Street Station, and four stokers of this type are being installed under 1232-horsepower boilers. They are built for a maximum capacity of 300 per cent of boiler rating and are being equipped with a grinder for automatically discharging the ash and refuse.

There have been a number of cases in the past year where old equipment has been replaced by the more modern forced draft underfeed equipment in order to obtain more capacity without a change in the boiler equipment. The United Railway & Electric Company, Baltimore, Md., is replacing old equipment by forced-draft underfeed stokers under 16 450-horsepower boilers.

A number of other large central stations have made extensive installations of stokers during the year.

Overfeed Roney and Chain-Grate Stokers.—Even though many of the large central stations have selected the forced-draft underfeed stoker, the demand for the Roney stoker has still kept ahead of the available production. Most of the installations in the past year have been confined to small industrial plants, or to extensions thereto. On account of the simplicity of this stoker and the fact that no forced-draft equipment is required, this type has been selected in many cases where a quick installation is desired.

Inquiries for chain-grate stokers have decreased because many central stations that formerly used them are now installing the forced-draft underfeed type. Business, however, has been very active in the extreme West, especially in the beet-sugar plants. One interesting installation of chain-grate stokers is that at the Atlantic Refining Company, Franklin, Pa., which will use 12 such stokers in connection with oil stills.

Generating Equipment.

The past year has seen little that is radically new in generating equipment. More units of large individual capacity have been contracted for than ever before due to the growth of the larger central stations. The Westinghouse Company has sold several large units ranging from 40,000 to 70,000-kilowatt capacity and these either have been or are now being installed. Those units above 40,000 are of the cross-compound or triple-element type. Among those reported last year but just recently installed may be mentioned: the Duquesne Light Company, Pittsburgh, Pa., a 40,000-kilowatt cross-compound unit; Narragansett Electric Company, Providence, R. I., a 45,000-kilowatt cross-compound unit; and the Interborough Rapid Transit Company, New York City, a 70,000-kilowatt triple-element unit.

The increase in cost of coal has brought about some increase in hydro-electric stations and among the larger installations made during the past year might be mentioned that of the Montana Power Company at Holter, Mont., where there are installed four 12,000-kilovolt-ampere vertical units. The power from this

plant is used very largely on the electrification of the Chicago, Milwaukee & St. Paul Railroad and the saving in coal due to use of water power is a very considerable item. This railroad has purchased from the Westinghouse Company a large amount of new equipment for an immediate extension of the electrified zone, despite the present high cost of materials and the shortage of labor.

The Rochester (N. Y.) Railway & Light Company has installed two 12,500-kilowatt vertical water-wheel units, which marks a very considerable increase in the generating capacity of this system.

At Junction, Mich., the Eastern Michigan Power Company has installed three 6250-kilowatt vertical water-wheel units, in a plant whose ultimate capacity will be 25,000-kilowatts.

One of the developments brought about by the high cost of copper and other materials, labor, etc., has been an increased tendency toward the use of synchronous condensers for both power-factor correction and voltage regulation. In many cases the installation of such apparatus saves an increase in transmission-line copper, or allows additional load to be taken on a given transmission line, and at the same time permits the maintaining of normal and satisfactory voltage conditions. Typical of this tendency is the case of the Duquesne Light Company, Pittsburgh, Pa., installing three 7500-kilowatt Westinghouse synchronous condensers for this purpose.

Switchboard Equipment.

The outstanding feature of switchboard business has been the continued purchase of switchgear for power stations of tremendous initial and ultimate capacity. Initial capacities of 66,000 and ultimate capacities of as high as 387,000 kilovolt-amperes are represented in installations projected and for which switchgear was purchased during the year.

Despite the heavy load represented by continued development of high-powered stations the Westinghouse Company has, as in the past, devoted considerable attention to improvements, not only in the major apparatus forming a part of this switchgear equipment, but also in the smaller details.

There may be mentioned the completion of a number of 150,000-volt outdoor oil circuit-breakers of rupturing capacities far in advance of anything heretofore within the limits of high-voltage breakers. These breakers have round instead of elliptical tanks, domes instead of flat tops and are of all-steel construction with the result that guarantees of their withstanding possible internal pressures of 150 pounds have proven very conservative. In fact, with the guaranteed arc-rupturing capacity of 1,000,000 kilovolt-amperes with voltage maintained it is felt that question of high-voltage power concentration is solved for at least some time. Similar breakers with the same guarantees are also being built for 110,000-volt service.

By combining the space advantages of one of the older types and the rupturing ability of one of the modern types, a new type of high-powered station breaker for voltage up to 23,000 volts has been developed. The compact type of operating mechanism of the former breaker with its characteristic common supporting top for all tanks with the round tanks of the latter and its characteristic all-steel construction with highly accelerated tripping has resulted in a line of breakers with a short-circuit arc-rupturing capacity of 625,000 kilovolt-amperes at 15,000 volts, which represents the greatest advance to date in high-powered, compact, moderate-voltage, cell-mounting oil circuit-breakers.

Among other developments, might be cited the frame-mounted, indoor and outdoor high-powered steel top, 73,000-volt breaker; combination 37,500-volt and 132,000-volt outdoor, single-pole, disconnecting switches and choke coils all on a common base, with a resulting net saving of one insulator supporting column; and 66,000-volt post-type bus supports and disconnecting switches.

Typical of the attention constantly being given to improvement in switchboard mounting devices is the development of a very compact and improved drum-type circuit-breaker controller. Likewise along the same lines may be mentioned the completion of an adequate line of meter switches, also of drum type, key-operated, including ammeter, voltmeter, synchronizing frequency meter and power-factor meter switches. With the completion of these, all plug switches for meter switching can be eliminated, thus insuring the entire absence of any potential from the front of panelboards or control desks.

Increased use of outdoor switch houses has been noted. The highest operating voltage heretofore utilizing these had been 2500; a considerable number of installations have now been made which control circuits up to 6600 and 11,000 volts. Single orders received involving as many as ten houses are proof of claims made as to the economy represented by their use for distributing small amounts of secondary-voltage power from transmission lines in connection with outdoor stepdown transformers.

With possibilities of destructive short circuits from high-powered installations particular attention has been paid to the question of affording adequate protection to potential transformers for meters directly connected to power buses. This development has taken the form of a suitable resistance tube supported on a post-type insulator similar to those used for bus supports connected in the primary of the transformer. The design is such that accuracy of the transformer is in no way affected while at the same time possible current fed to the transformer in case of a short-circuit is limited by preventive resistance.

There may also be mentioned the development of what gives promise of being a highly successful and yet simple control equipment for automatic rotary-converter substations. One such outfit has been in successful operation for some time and others are under construction. To a very large degree, the bulk and complexity of earlier control equipment for such installations have been eliminated.

Lightning Arresters.

The principal change in electrolytic-arrester design has been in the main gap. The use of sphere gaps in combination with horns first came into use as a special design, and later was adopted as a standard by all manufacturers on all voltages above 11,000. At these voltages, the use of a sphere gap reduced the time required for a static surge to break down the gap and discharge to ground through the arrester.

For the protection of apparatus on railway cars further developments have been made in the use of condensers by surrounding the condenser with a molded insulating case, making an easily replaceable unit impervious to moisture. The capacitance has been increased to one microfarad in all forms of arresters, both car mounting and pole mounting, giving a static discharge capacity sufficient to take care of the worst conditions found in practice.

Switches, Fuse Blocks and Carbon Circuit-Breakers.

A new line of front-connected knife switches has been put on the market, embodying the most recent ideas in the construction of such switches. In the rear-connected line, the larger capacity switches have been put out in the new form to supply a line having laminated studs, or combinations of laminated and round studs, giving the maximum convenience for switchboard mounting where busbar connections are made direct to the stud.

A new form of transformer-type fuse block suitable for use up to 30 amperes, 7500 volts has been marketed and received with great satisfaction. In this the safety principle has been given supreme consideration by mounting the fuse element on the door of a wooden box so arranged that when the door is opened, the element is disconnected at both ends from the line and transformer. This construction not only provides complete safety, but requires no auxiliary tools, such as tongs or a stick for removing the fuse tube.

A complete line of polarized reverse-current mechanically connected relays has been introduced for the larger carbon circuit-breakers. This form of relay does away with the complication and possible errors of a separate relay electrically connected with the breaker. It also has the desirability characteristic of operating on high current with a great drop in voltage, as during the short circuit close to the breaker, and operating at a very low current on normal voltage. This device will not operate on an overload of any value in the forward direction, although very sensitive in the reverse direction.

Graphic and Other Instruments.

A line of motor-operated graphic instruments has been added to the Westinghouse line of solenoid-operated instruments in order to make the line more applicable for portable service and for metering large customers' demands. These instruments are made as voltmeters, ammeters, wattmeters, totalizing wattmeters, and frequency meters. They embody the same measuring element as used in the solenoid-operated instruments and have the same accuracy characteristics. They differ from the previous line of solenoid instruments, in that the contacts of the measuring element actuate a small universal motor, driving a worm upon which the pen carriage is arranged to travel. The case is also somewhat smaller and designed for rear connection. The clock is so arranged that the standard paper speeds can be obtained without changing it.

There has been developed an improved type of reroll attachment which is operated by the clock-winding motor of graphic instruments, and will satisfactorily collect approximately half a standard roll of paper, or about one month's record at 2 inches per hour chart speed, and about one week's record of 8 inches per hour chart speed.

Transfer relays are used with circuit-closing, protective relays that operate on excess current, such as overload, reverse-current, and reverse-power relays, etc. They energize the trip coil of the circuit-breaker through current transformers, having a secondary rating of five amperes, and obviate the necessity of providing a separate source of power for shunt tripping. Heretofore, storage batteries have often been installed at great expense, so that separate sources of power could be available.

An internal contractor switch for overload and reverse-power relays has been designed to protect the main contacts of protective relays. The contacts of this switch are in parallel with the main contacts of the relay, and thus when the relay acts, the main contacts are immediately short-circuited, preventing the relay from reopening the circuit, until it has been reopened by the pallet switch. The device is assembled complete as a unit, and can thus be applied to existing relays wherever desired.

Duplex instruments were designed for application on electric automobiles, small charging panels, small isolated lighting plants, or electric plants of small vessels. They consist of a pair of standard instruments combined in duplex form case. The two voltmeters or two ammeters can be furnished, assembled together, or one or both instruments can be calibrated as temperature indicators, speed indicators, etc. The instruments can be furnished with special scale marking, such as zero center, or for higher capacities than those listed. They are made in two sizes.

Street-Lighting Fixtures.

The most notable addition to street lighting during the year is a fixture for the high-current street series lamps of large candlepower. It is made of cast iron and is suitable for either autotransformer or film cut-out socket. Similar fixtures, which have been in service several years, indicate that this is a very desirable modification, as the cost of equipment can be reduced without sacrificing any desirable qualities.

The increased use of the skirted type of Holophane refractor with fixtures for street-lighting service indicates the growing appreciation of the ideal distribution given by this simple device.

Street-Railway Motors and Controllers.

The line of standard railway motors has been worked up to a point nearing perfection and very gratifying service reports indicate previous predictions were more than justified. During the year the standard line of Westinghouse motors has been supplemented by the motor having a rating of 200 horsepower at 600 volts. This motor is especially suited for heavy subway service and heavy interurban service where exceptionally heavy duty is required, and is in striking contrast to the "Wee" motor brought out by the company, which is the pioneer motor in quick-service single-truck car application. It is gratifying to note and of decided advantage to the trade to report stability in design of the present line which enables the user to standardize for some time to come.

The multiple-unit types of control previously reported are coming into their own. Scarcity of labor and heavy peak-load haul has now convinced the user of the advantage to be obtained. The H. L. & H. L. D. types of control have been completely developed into a one-piece outfit resulting in economy in space and simplicity of wiring and mounting. Regeneration has been extended to ordinary interurban application, especially in locomotive service and this development will rapidly extend in this field.

Steam-Railway Electrification.

The past year has seen considerable detail development and improvement in apparatus pertaining to electrification of steam railroads. The requirements for heavy freight traffic on mountain-grade sections have been met by the production of a very powerful split-phase locomotive, having several improvements over those previously built. This locomotive, while only weighing 250 tons complete, has a horsepower capacity of 4800 and a maximum tractive effort of 130,000

pounds, all of which is concentrated in one single-cab unit. The most interesting improvement in this type of locomotive is the synchronous phase converter, by which 100 per cent power-factor is obtained on this locomotive, thus eliminating some of the line losses which were encountered with the induction-type phase converter.

The high-voltage, direct-current system has also shown advance in the production of a high-powered passenger locomotive. The rating of this locomotive will be 4000 horsepower and the starting tractive effort will be 112,000 pounds, while the total weight will be 266 tons. This engine will also be a single-cab unit. There are many detail improvements in the design of both the mechanical and electrical features of this engine, but these are too numerous to mention in a brief review.

Regenerative control for direct-current locomotives has been perfected to such an extent that it is now applied whenever desired to 600-volt units as a standard. This feature contributes very largely to the safety in operation of the electric locomotive, and its principal value lies in the fact that it relieves the air brakes from considerable strain and enables them to be used as a reserve for stopping trains only.

The development of high-speed circuit-breaker methods for suppressing flashing in high-voltage direct-current apparatus has taken very forward steps during the past year and the indications are that this serious trouble in machines of this class has been definitely suppressed. These devices are of various kinds and very unique in character, the details of which will receive publicity at a later date.

These detail developments have put the electrical industry in a position of preparedness for the more general electrification of railroads, which it is anticipated will become very active in the near future.

Electrical Equipment for Special Industries.

Steel Industry.—The electrification of steel mills is progressing at a very rapid rate. The business of the Westinghouse company during 1916 and 1917 was more than three times as great as for the average of the five previous years. During the year the company received an order for one of the largest reversing-mill equipments ever built, this machine having a maximum rating of 17,500 horsepower and will be used to drive a 60-inch universal plate mill for the Bethlehem Steel Company. Out of a total of 28 reversing-mill equipments furnished and on order, the Westinghouse company has received orders for 18 equipments.

Rubber Industry.—There has been developed during 1917 what is known as a tandem-type controller for calender work, which is of the magnetic-switch type and is controlled from a push-button station. Besides the convenience offered by the latter, it adds to the safety feature, as the motor can be stopped from various stations conveniently located to the operator. Other safety features are included affording overload protection, automatic acceleration, etc. In this particular case, the calenders are located in tandem, in some cases as many as four machines being operated in series. With the old arrangement of drive, the calenders were operated as individual units, and after the process in each individual calender was completed, the material had to be wrapped up and taken to the next machine, and the work thus carried on independently by the various machines. With the new arrangement, the material passes from one machine to the other in a continuous process which saves time, labor and materially increases production. The control mentioned above makes possible the proper regulation of drive, and is considered a great improvement in rubber-mill work.

Textile Industry.—A new type of apparatus developed last year which is used extensively in the textile industry is the Westinghouse quick-make starting switch. It is used where squirrel-cage motors of comparatively small capacity, i. e., up to 25 horsepower, 220 volts, are started with full line voltage. Besides the quick-make and break features, it has the following combinations: non-automatic switch; switch with low-voltage protection; switch with inverse-time-element overload protection; full automatic switch with low-voltage and inverse-time-element overload protection.

There has been a marked tendency during the year for the textile industry to install individual drives, as compared with group drives, and it is believed that very rapid progress is going to be made in the development of this idea. There have also been a large number of plants changed over to electric drive—in practically all cases using central-station power.

Small-Motor-Driven Devices.

The business in small-motor-driven devices used in the home, office, and shop during the last year has been very active. As in all other industries, the activity has been more pronounced in connection with those motor-driven devices which contribute either directly or indirectly to the carrying on of the war. For instance, there has been a large sale of motor-driven drills, grinders, polishers, and small tools generally. This has also been true in the case of motor-driven machines required in the preparation of food and those in the home which are distinct labor savers, such as electrically driven washing machines. The extreme scarcity of household help has created a very large demand for these. On the other hand, the demand for non-essentials, such as motor-driven pianos, talking and recording machines, office appliances and advertising novelties, has become less active.

General Industrial and Building Equipment.

In the industry covering the equipment of electrical apparatus for large buildings there has been a great deal of activity, due principally to that of industrial rather than public buildings. It appears quite likely that the public building and residence industry will be very severely affected, in fact this is already noticeable.

Considerable electrical apparatus has been purchased by bakers and all those engaged in the manufacture or preserving of food products. Likewise, the clothing industry has been a very active one.

The prosperity of the farmer and the scarcity of labor on the farm has made an abnormally large demand for electrical equipment in the comparatively small areas where central-station current is available, and particularly in the demand for small isolated lighting plants, most of which are supplied with storage batteries. This has stimulated the demand for low-voltage motor-driven pumps, washing machines, vacuum cleaners, churns, separators, and similar devices.

Arc-Welding Apparatus.

The advance made in the past year in arc welding has been important. Heretofore, the arc-welding voltage has been 75, but the Westinghouse company has recently designed a new line of arc-welding equipment with an operating voltage of sixty volts, and the machines also are running at the highest and most efficient

speeds. The drop in voltage from 75 to 60 will mean a saving in power.

Further, the company has developed portable welding outlet panels which will simplify the shop wiring and will decrease the total expense of the installation.

Mining Equipment.

In the metal-mining field there has been developed a control panel offered where a wound-rotor motor is used. It combines a circuit-breaker controller and meter in conveniently small space and prevents the motor being thrown on the line without resistance in the secondary circuit.

Several new ratings of Cottrell equipment including motor-generator sets, transformers, and synchronous-induction motors were brought out during the year so that a standard equipment to meet most commercial conditions can be furnished.

For the flywheel hoisting sets, the greatest improvement has been in the control, as the cam type controller for the generator field rather than the old face-plate type is furnished.

For coal-mining substation service, a 100-kilowatt high-speed 60-cycle rotary converter and also a high speed 150-kilowatt set has been under construction.

There have been few changes in the mining locomotive made this year with the exception of offering two smaller sizes than previously. The Westinghouse company now lists with its equipment the G type Edison cell, which is particularly adapted to mining service.

Industrial Heating.

The greatest activity during the year has been in the development and exploitation of new industrial-heating applications. Enameling and japanning ovens have been applied in an increasing number of industries. They are quite generally used in the automobile industry for baking the finish on bodies, fenders and other metal parts of cars. Other applications are to the baking of varnish in shells, japanning baby carriages and toy wagons, japanning and enameling motor frames, baking the paint on washing machines, enameling wire, finishing metal furniture, etc.

The use of electric ovens for drying purposes and baking electrical insulation has also been extended. The use of electric heat for hot presses used in molding electrical insulation, vulcanizing rubber goods, stamping and embossing, and other hot press work has been growing steadily.

Special ironing and pressing operations, such as the manufacture of paper and micarta tubing, ironing gun stocks, folding insulation, forming celluloid, etc., have been increasing in number. The use of electrically heated hot plates for celluloid working has proven very successful especially because of the elimination of the fire hazard, which was present when gas was used for this purpose.

Electric immersion water heaters have been applied in a great many industries especially where a quantity of hot water is required in localities in which a gas fire would be a source of danger in which steam is not available. Electric water heaters are also in use in increasing quantities for heating sterilizers for hospitals.

A recent development is an electrically heated platform suitable for use in the crow's nest of ships and other places where a sentry, watchman, or lookout man may be called upon to do continuous duty in an exposed position during extremely cold winter weather. By the use of such a device for a man to stand on, it is found that all danger of freezing the feet is eliminated and the efficiency of the man is greatly increased. This device can be used on stations for traffic policemen, crane-operator cabs and a large number of other industries.

Household Heating and Cooking Appliances.

The company has developed a low-priced utility iron of the six-pound type, devoid of all the superfluous details not necessary to efficient operation and long life. A new 9 by 12-inch heating pad is an innovation insofar as size is concerned, the normal pad generally measuring 12 by 15 inches or larger. This size is proving very popular.

There has been developed a new type traveler's iron, differing from the old iron in having a solid handle and non-separable cord and plug. Provision is made for the heating of an ordinary curling iron.

The company has brought out a complete line of semi-automatic ranges, which have a contact thermostat on the oven doors that rings a bell when a predetermined temperature is reached which may be varied by manually setting the contact point on the thermostat. This prevents the housewife from scorching foods as the bell calls her attention to the fact that the maximum temperature has been reached and the current should be turned off. This alarm also prevents overheating of the oven lining and rapid deterioration.

Electrochemical and Related Apparatus.

The past year has witnessed not only a healthy continuation but some remarkable increments in the already rapid growth of most of the industries depending upon electrochemical, electrothermal and electrophysical processes.

Electrolytic zinc has gained further commercial recognition as a high-grade product; although, as no new plants of any great magnitude have been placed in operation, the total output has only moderately increased.

The output of aluminum which is produced only through the electrochemical and electrothermal reactions of the electric reduction furnace has taken a bound forward, owing to the practical completion of large new reduction works.

In the production of copper, a development of greatest importance has occurred. The first large commercial leeching and electrolytic plant to be erected in the United States has been placed in full operation: 5000 tons of ore per day are crushed and then acid leeched, the resulting solution being subjected to electrolysis. The output is nearly 5,000,000 pounds of electrolytic copper per month. As there are untold quantities of low-grade ore in the United States susceptible of similar treatment, this installation is but the forerunner of greater developments.

Owing to the tremendous increase in the total amount of higher grade copper ores and concentrates smelted containing objectionable impurities, as well as impurities of value, such as gold and silver, it has been necessary for electrolytic refining to grow apace. One of the largest refineries has practically doubled its capacity by the installation of additional units.

Electrolytic refining of lead has been engaged in on commercial scale in several places.

Turning to the electric furnace in ferrous metallurgy, the demand for high-grade, refined steels and for steels alloyed with a predetermined and consistent accuracy, has resulted in the starting up of a multitude of furnaces in the Pacific and inter-mountain states, as well as in the middle Atlantic and eastern central states.

Trade Activities

New Additions and Buildings Opened—Calendars, New Year Cards and Catalogs Being Distributed—Other Activities

Ridgway Dynamo & Engine Company, Ridgway, Pa., announces that it has appointed the Blake Electric Manufacturing Company, 1 Rowes Wharf, Boston, Mass., as its sales representative for the New England states.

Central Electric Company, Chicago, Ill., announces that on January 1 the name of Fifth Avenue was changed to Wells Street, so that its address is now 316-326 South Wells Street, the location of the company's headquarters being, of course, unchanged.

The Esterline Company, Indianapolis, Ind., announces the removal of the offices of James G. Biddle & Company, representatives in the New York territory of the Esterline Company, from 90 West Street to 15 Park Row, New York City. This change was made in order to facilitate the handling of the business in the New York district.

The Edw. E. Early Company, Canton, Ohio, is sending out a circular on its commutator cement, one of the strongest insulating and adhesive cements known. The cement is used by electricians all over the world for quick motor or generator repairs, for repairing pitted commutators without facing; it joins metals, glass, wood, mends fuse and switch blocks, and is a powerful adhesive for almost any article or combination of articles.

Crocker-Wheeler Company, electrical machinery manufacturer of Ampere, N. J., through its president, Dr. Schuyler S. Wheeler, has announced a bonus to its employees to meet unusual conditions incident to the war. Under this bonus employees will receive not less than 10 per cent of their wages since October 1, 1917, and during 1918. All employees receiving less than $2500 yearly will benefit and those who have been in the employ of the company for more than a year will receive 12 per cent of their earnings.

Fort Wayne Works of General Electric Company, Fort Wayne, Ind., are being so improved as to greatly facilitate manufacturing. A new building is being erected for the installation of motor-driven shop tools and machines, to relieve the congestion of work in existing shops. This building occupies a ground space 75 feet wide, 375 feet long, including projecting wing; it will have five stories and basement, and is being constructed of reinforced concrete. The power and light wiring is being installed in concealed, rigid metal conduits, connecting with distributing panels throughout. The large number of motors to be installed will consist of both alternating and direct-current machines, the plan providing for an individual motor for each shop machine. The character of the shop work requires many motors of less than five horsepower. These works are supplied with power partly from their own generating plant, and partly from the central station of the Fort Wayne & Northern Indiana Traction Company. The generating plant at the works includes direct-current equipment to serve certain phases of work.

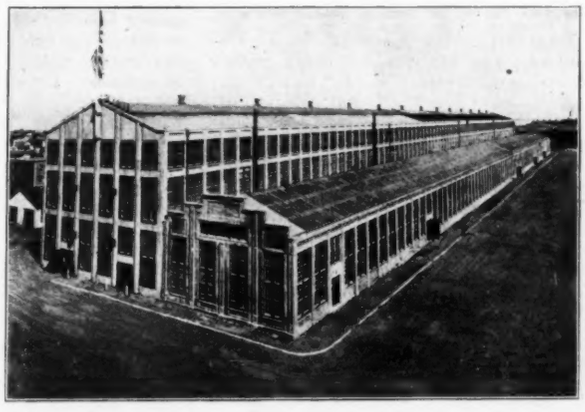
E. C. Atkins & Company, Inc., with headquarters at Indianapolis, Ind., manufacturers of the famous Silver Steel saws, are conducting a central-station campaign on the Atkins non-breakable hack saw blades. These saws, which are made with the usual hard edge, but with a soft back that prevents breakage, have an edge tempered to insure a cutting capacity equal to "all hard" blades. Therefore, while the blade will cut equally fast and hold its cutting edge as long as the "all hard" blades, the liability to break or snap off is entirely eliminated. It is the best blade for plumbers, structural iron workers, electricians and machinists, because it will stand the hardest service on the most difficult jobs and where inexperienced help is employed, without snapping to pieces. It is made in lengths of from 6 to 16 inches, ½ to 9/16 inch wide, and with 14 to 24 teeth to the inch. To prove the quality of this saw the company is giving away samples, which are sent to any central station filling out and mailing to the company specially provided blanks.

The Arnold Company, 105 South La Salle Street, Chicago, which does civil, electrical and mechanical engineering and construction work, is sending out effective New Year greetings in the shape of a folder card.

Hoyt Electrical Instrument Works, Penacook, N. H., is sending out an attractive and patriotic New Year greeting. This card bears an embossed figure of the Statue of Liberty, strikingly reproduced in blue and gold, with a panel conveying the patriotic wish, "May Liberty Enlighten the New Year."

K. McLennan & Company, Chicago, sole manufacturers of Gale's commutator compound, report doing a larger foreign business during 1917 than in any previous year in the history of the company. This product has been in the market for over 25 years and the manufacturers claim that it is known wherever there is need for a compound of this kind.

General Electric Company five years ago at Lynn, Mass., completed the largest single building in the world devoted exclusively to the manufacture of electric motors. The original structure was 809 feet long and 82 feet wide, with a floor space of nearly five acres, which was expected to suffice for years to come. However, the demand for G-E motors has so increased that an addition became necessary. The extent of this addition may be appreciated from the illustration herewith. The new wing covers the entire length of the original building and is 56 feet wide.



New Addition of General Electric Company at Lynn, Mass.

With this increase the total floor space in this building devoted to the manufacture of motors from 1 to 50 horsepower is nearly six and one-third acres. While the abnormal conditions of the last two years have taxed the company's manufacturing ability beyond its capacity, still greater productive facilities are under way, which it is believed will, within reasonable time, fill all the motor requirements of the many customers whose standards of quality are only satisfied by General Electric product.

The MacGillis & Gibbs Company, Milwaukee, Wis., has issued a convenient booklet entitled "Pole Buyers' Manual." This contains much valuable information for the purchasers of poles for various overhead electric lines. The production of northern white cedar poles is described, together with the excellent facilities of the company at its three yards at Gladstone, Mich., West Duluth and Minneapolis, Minn. Suggestions and data are given for finding the number of northern white cedar poles required to make a carload. Methods of butt treating of cedar poles and prices for three types of treatment are given. The booklet gives official specifications of the Northern White Cedar Association, together with tables and diagrams to illustrate them.

Men in Service

Newark Public Service Corporation Gives 700—Wisconsin Engineer Enlistments—Washington Engineers Doing Bit—Westinghouse Engineers Selected by Navy Department

P. H. RIDGWAY, electrical and mechanical engineer, located at 916 Post Street, Seattle, Wash., was some time ago commissioned captain of Engineers U. S. R., and is anticipating orders to report some time in January.

L. H. KELLER, sales manager of the Moloney Electric Company, St. Louis, Mo., and formerly district manager for the same company at Chicago, has received a commission and has joined the army. Mr. Keller is a graduate engineer and is widely known in the transformer field.

JAMES T. HUTCHINGS, vice-president and general manager of the Rochester Railway & Light Company, Rochester, N. Y., has been appointed by the Government to expedite the production of supplies at Rochester and in other ways to actively co-operate with the War Department. Mr. Hutchings volunteered his services to the Government after he was recommended by the Chamber of Commerce for this work. He is one of the best informed men in Rochester to carry on this arduous work.

THE WISCONSIN ENGINEER in its December issue has the following names on its honor roll: G. E. Bachhuber, Band 120th F. A., Camp McArthur, Waco, Tex.; Lieut. J. V. B. Cox, 30th Company, 160th Depot Brigade, Camp Custer, Mich.; Nicholas C. Drolenga, Company C, 8th Mounted Engineers, Camp Stewart, Fort Bliss, Tex.; Lieut. E. W. Fisher, Coast Artillery, Fortress Monroe, Va.; Lieut. J. M. Gillette, Ordnance Department; Second Lieut. Ralph A. Grant, Coast Artillery, Fortress Monroe, Va.; John Hall, 127th Infantry Band, Camp McArthur, Waco, Tex.; Sergt. Lester O. Klandrud, Company L, 6th Wisconsin Infantry, Camp McArthur, Waco, Tex.; D. G. Lehman, Sec. H., 1st Wisconsin Field Hospital, Camp McArthur, Waco, Tex.; Robert Luhmann, Band, 120th Field Artillery, Camp McArthur, Waco, Tex.; O. W. Martin, U. S. Military Academy, West Point, N. Y.; L. F. Nelson, R. O. T. C., Ft. Sheridan, Ill.; Lieut. R. B. Pearce, Company E, 310th Regiment Engineers, Camp Custer, Battle Creek, Mich.; Second Lieut. R. J. Roark, instructor in mechanics; Private E. R. Stivers, Company I, 313th Regiment Infantry, Camp Meade, Maryland; Private Walter Todd, National Army, Louisville, Ky.; First Lieut. Chester D. Walz, Fort Riley, Kans.; First Lieut. J. P. Woodson, 307th Engineers, Camp Garden, Atlanta, Ga. Wisconsin men at Fort Leavenworth Camp in training for the Engineers Corps are: First Company—First Lieuts. Walter E. Jessup, W. L. Breckenridge, A. J. Barclay; Second Lieuts. P. W. Wilder, C. J. Popelka; Capt. J. A. Pierce. Second Company—Capt. Ray S. Owen; Second Lieuts. H. N. Brue, Ray C. Phelps; R. D. Watson, L. G. Eisele and Mr. Davis.

ROLL OF HONOR.

The electrical industry, perhaps to a greater extent than any other industry, has answered the call of the Nation for men. As this is a war of engineers, naturally the technically trained men in the electrical industry have been in great demand and they have responded with splendid patriotism. Many of the large utility and industrial corporations have assigned men for Government service aside from those who have voluntarily entered or been called for service.

THE ELECTRICAL REVIEW will *welcome news concerning men who have entered the service or who are engaged in any patriotic duties.*

THE PACIFIC TELEPHONE & TELEGRAPH COMPANY has an attractive cover design of its service flag on the December issue of The Pacific Telephone Magazine. This flag has a red background, with a white center box, on which is a blue star and the figures 550 in blue, representing the number of employees who have entered service.

DUQUESNE LIGHT COMPANY, Pittsburgh, Pa., in its December issue of Light Company News, presents a very attractive front cover of its service flag in the colors blue and white, with a red border. In the center of the 312 blue stars on the white background are listed in gold letters the names of the companies represented, being the Duquesne Light Company, Equitable Gas Company, Philadelphia Company and Pittsburgh Railways Company. This flag hangs in the entrance hall to the Philadelphia Building in Pittsburgh.

AMERICAN ASSOCIATION OF ENGINEERS, Washington (D. C.) Chapter is doing its bit and is working with full power to enable the Government to secure desirable and qualified technical engineers. At a meeting held December 14, in Washington, at which were present Admiral F. R. Harris, Chief of the Emergency Fleet, Admiral Baird, Major Zimmerman of the Engineers' Depot and Major Harrison, a vivid description was given by Capt. D. S. Hays, of the Engineer Corps, U. S. A., telling how the organization rose from a small beginning, struggled and finally overcame all obstacles, attaining its present success and how the war work was being handled so effectively. The members believe the maximum benefit to the technical profession and the Government will be realized when the engineers are working hand in hand with business organizations.

L. C. FORDHAM, of the Foster-Raetz Electric Company, Rochester, Minn., recently entered Government service as an electrician with Base Hospital Unit No. 26.

ILLINOIS PUBLIC UTILITIES COMMISSION, Springfield, Ill., has unfurled a Red Cross service flag showing 110 per cent membership of the personnel of the Commission and employees. There are 106 stars on the flag.

A. H. FERRANDOU, a member of the rate and statistical department of the United Gas & Electric Engineering Corporation's New York office, has been appointed to war duty in the Ordnance Department at Washington, D. C. R. E. Chew, of Colorado Springs, Colo., succeeds him at New York.

SOUTHERN CALIFORNIA EDISON COMPANY devotes the front cover of its December house organ to a reproduction of its service flag. The white panel bearing 232 blue stars, has a red background, and the lettering on the cover is done in white print, including the following words: "Christmas greetings to our men who have gone to war." The stars are strikingly arranged in portiere effect.

CHAS. A. SCHIEREN COMPANY, New York City, in loyalty to its employees in service, has made up small stickers or posters as a service flag, being about 1¼ by 1¼ inches in size. This little red flag has 29 blue stars in the white square. At the top of the flag appear the words "For Democracy," in black type, and in the lower right-hand corner, in very fine black print, Chas A. Schieren Company, New York.

GEORGE WILLIAMSON, from the office of the president of the Commonwealth Edison Company, Chicago, was tendered a farewell luncheon December 18, at the Brevoort Hotel, before leaving for service in the Army. He was presented with a wrist watch, with the appropriate speech that as it was one of the cardinal principles of the soldier to be on time, it was hoped with the assistance of the watch he would not fail in the matter of punctuality. He left December 19 for Camp Joseph E. Johnston, Jacksonville, Fla., for training in the Quartermaster's Enlisted Reserve.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, with headquarters at 33 West 39th Street, New York City, in its December Institute Proceedings publishes an honor roll containing 480 names. This list includes only those members who are in the armed forces and who have responded to the war service card sent to the membership on September 15, 1917. Members in Army and Navy service who are not listed are requested to communicate with Institute headquarters. The majority of the members in service are officers of rank in the Army, Navy or Aero service.

THE SOCIETY FOR ELECTRICAL DEVELOPMENT, INC., 29 West 39th Street, New York City, is proud of six stars on its service flag, representing men from its executive staff, which had a total of 15. Those in service are Hill Griffith, captain, 313th Infantry, Camp Meade, Md.; R. R. Jones, 1st lieutenant, Signal Corps, Silver Lake, N. J.; E. A. Allen, 2d lieutenant, Regular Army, France; A. R. Ayres, chief yeoman, Transport Service; J. J. Flynn, 306th Infantry, Camp Upton, New York, and Fred J. Jagemann, Ordnance Department. In addition to the absentees, Theodore Dwight of the Society's Engineering Corps is a member of the Seventh New York Guard, subject to call. Roy B. Woolley, until recently of the American Field Ambulance Service, Verdun front, France, having served his enlistment, has returned and is now on the Society's staff.

COMBUSTION ENGINEERING CORPORATION, New York Citv. has given a number of its men for Government service, among whom are: C. L. Bachman, former manager of the Chicago office, is now lieutenant of engineers. Mr. Bachman has acquired a lieutenant's commission and a bride in the last four months. O. de Lorenzi, formerly of the force of testing engineers, is now 2d lieutenant of engineers, attached to headquarters company. Mr. de Lorenzi has also acquired a bride along with his commission. George M. Bechtel, formerly of the estimating department, is now enlisted with the Base Hospital No. 3. Walter Erlenkotter, formerly of the testing corps, is now 2d lieutenant of the engineers, and Marcus Morley, of the same department, is 1st lieutenant of engineers. Hugh Campbell, of the designing department, is with the national army at Camp Upton, and Robert Weber, of the same department, is with the 3rd District Naval Reserve. Herbert Ahearn is with the 5th Battalion Naval Militia, New York. Sergeant Murray Harris is with the O. E. R. C., Camp Upton; P. Nelson Hunt, with U. S. Aviation Corps, Raymond Zimbis, U. S. A. Flying Corps, Mineola, L. I., and J. M. Hunter, with the Royal Flying Corps.

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, East Pittsburgh, Pa., furnished 11 of the 100 men recently selected by the Navy Department as engineer officers with the rank of Lieutenant (J. G.) U. S. Naval Reserve Force. After a short period of training at the Naval Academy at Annapolis, Md., the officers will be assigned to active duty. These men, as shown in the photograph herewith, are: Upper row—A. L. Faber, from St. Louis office; W. S. Edsall, New York office; R. Kelly, power engineer, East Pittsburgh; D. E. Renshaw, railway engineer, East Pittsburgh; L. G. Fear, Portland office; W. R. Clements, Cincinnati office. Lower row—W. D. Thompson, general engineer, East Pittsburgh; W. H. Smith, railway engineer, East Pittsburgh; W. W. Reddie, industrial department, East Pittsburgh; C. M. Brown, general engineer, East Pittsburgh; W. M. Robbins, industrial department, East Pittsburgh.

Another Engineering Regiment for service over seas is being recruited from the electrical industry, to be known as the 37th Engineers. This regiment will be organized at Fort Myer, Va., and will be for the purpose of performing electrical installation, operation and maintenance in France. The co-operation of the various engineering organizations has been enlisted, including the AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, New York City, which has placed the roster of the Engineer Reserve Corps of its organization available as officers for the regiment. The classifications which it is desired to include in the enlisted personnel of the regiment are: Engineers, stationary; motor truck drivers; electricians; cable splicers; linemen; expert test men; wiremen; armature winders; machinists; pipe fitters; carpenters; blacksmiths; handymen; cooks. The pay of the enlisted men is determined by their military rank. The following is the schedule on foreign service: First sergeant, $60; sergeant, first class, $60; supply sergeant, $51.20; mess sergeant, $51.20; stable sergeant, $51.20; sergeant, $51.20; corporal, $40.80; horseshoer, $44; saddler, $40.20; wagoner, $40.20; cook, $44; bugler, $33; private, first class, $36.60; private, $33. Clothing and subsistence is furnished free to enlisted men. The opportunity to try for promotion as noncommissioned officers will be afforded to every enlisted man, as the regiment will be entirely new. The organization will be military as far as training, drills, discipline, etc., is concerned, as it is found that the health and efficiency of the men is in this way most readily maintained. Persons desiring to join the 37th Engineers should be advised to apply for forms to the Commanding Officer, 37th Engineers, Room 195, War Department, Washington, D. C. No enlistments will be received except by authority of this officer. Men in the draft age, but not yet called, may also make application.

Westinghouse Men Selected as Engineer Officers for Naval Reserve.

PUBLIC SERVICE CORPORATION, Newark, N. J., has about 700 of its employees from its various departments in Government service. Many have enlisted and some have been drafted into federal war services and the company is now operating handicapped by a serious labor shortage.

THE BELL TELEPHONE COMPANY OF PENNSYLVANIA AND ASSOCIATED COMPANIES, with executive offices in the Bell Parkway Building, Philadelphia, in its December issue of the Telephone News, shows photographs of a number of its boys in service, with letters printed from them. Among the interesting letters is one from Tom Galbreath, formerly of the Philadelphia accounting department, who is now training for an aviator's commission with the Royal Flying Corps at Camp Mohawk, Deseronto, Canada. He gives a vivid description of his first flight alone. Clifford T. Weihman is now top sergeant in the Army at Camp Meade, Maryland. Corporal Clayton T. Smith, who is with Company C, 109th Infantry, Camp Hancock, is shown as the captor of an opossum, which may be one of the mascots of his company. Acting Sergeant Morales C. Vendig is in the Signal Corps Battalion, stationed at Kelley's Field, San Antonio, Tex., and it is stated that it will not be long before he has his chevrons for keeps. E. L. Smith is top sergeant and crack football player of Company L, 315th Infantry, at Camp Meade. Among others mentioned, being located in the camps, in France and on the Deep are George K. Erb, of Company D, First Telegraph Battalion; Bill Grimm, formerly of the Pittsburgh plant department, now in France; Private James Jones, formerly cable tester, has bee ntransferred to Headquarters Company of the 110th Infantry at Camp Hancock, to do telephone work; Mark Fulmer is a signal corporal in the 108th U. S. Field Artillery at Camp Hancock; William H. McCormick successfully completed his course at the Fort Niagara Training Camp, and would have received a commission had it not been his desire to become connected with the Aviation Service. He is now in training for an aviator's commission at the Princeton Ground School, Princeton, N. J. Sergeant Charles Ashbaugh is with Battery A of the 329th F. A., Camp Custer, Michigan. He is now seeking to enter the coming officers' training camp for men in the service, so that he may win a commission. Private J. J. Kiphorn is serving in the Rainbow Division over in France, with Company B, 149th Machine Gun Battalion of the American Expeditionary Forces. Orville G. Conover, formerly a wireman in the Philadelphia plant department, is with the 151st F. A. overseas, as lieutenant in the Headquarters Company, and may be addressed in care of the American Expeditionary Forces. The cover design of this number shows a group of boys in service opening a Christmas box.

Personal

A. H. Meyer General Manager for Bryan-Marsh—C. T. McDonald Heads Multi Electrical—Fred R. Farmer, President of Beardslee-Chandelier—Other Changes Announced

I. STERNEFELD, representative of the Westinghouse Export Company in Shanghai, China, was in Seattle, Wash., recently on his way back to his post. He came to the United States in October and has been making a tour of the eastern states.

K. E. N. COLE, who has been connected with the general offices of the Fort Smith Light & Traction Company, Fort Smith, Ark., has assumed the management of the Van Buren branch of the company. G. B. DAVIS, who has been manager of the Van Buren branch, will continue as superintendent of the Crawford county business of the company.

A. H. MEYER has been appointed general manager of the Bryan-Marsh Division of the National Lamp Works of the General Electric Company, effective January 1. Mr. Meyer is one of the young men of the industry and his promotion came as a delightful surprise to

A. H. Meyer.

his host of friends. His rapid advancement to the highest position in the company in only seven years is a striking tribute to his ability and personality and should certainly be an encouragement to other young men. Mr. Meyer is a native of Nebraska and a graduate of the University of Nebraska in electrical engineering. He was born at Grand Island on March 19, 1886, and graduated in the class of '09. After leaving school he secured a position with the Faulkenaw Electrical Construction Company of Chicago and determined to pursue engineering work. About a year later Mr. Meyer was induced to enter the commercial field and became city salesman for the Bryan-Marsh Electric Works. He has confined his activity to sales work since that time, being in charge of city sales at the time of his promotion. Mr. Meyer brings the enthusiasm and spirit of youth into his new work and withal a realization of his responsibilities and a determination to make good. He succeeds the late E. H. Haughton and will continue the policies inaugurated by him, which have been largely responsible for building the Bryan-Marsh organization to its present enviable proportions.

FRANK W. HALL has been appointed commercial manager of the Sprague Electric Works of the General Electric Company. With the exception of a short period, Mr. Hall has been connected with the Sprague Works continuously for 22 years in various engineering and sales capacities, and for the three years prior to his present appointment occupied the position of sales manager. D. C. Durland, former executive head of the Sprague Electric Works, has resigned to accept the presidency of the Mitchell Motors Company, Inc.

C. T. MCDONALD, president and manager of the Multi Refillable Fuse Company, has severed his connections with that company, disposed of his interests in the same, and in the future will devote his entire time to the manufacture and marketing of the products of the Multi Electrical Manufacturing Company at 703 Fulton Street, Chicago. This new company will manufacture a complete line of slate base cutouts and accessories, also a line of porcelain wire bushings, and a line of conduit fittings, which will be marketed under the trade name "Multi." Mr. McDonald is interested in securing sales agents in every locality of the country. He has been associated in the manufacture of fuses and similar supplies for the last 15 years and has always advocated the standardization of electrical supplies on high-class lines and contended that the placing on the market of the cheaper and less efficient devices was a menace to the industry.

C. H. ANDREWS, assistant to president and chief engineer of the North Carolina Public Service Company, Greensboro, N. C., has been appointed general superintendent of the Southern Utilities Company, which corporation operates electric, gas and ice properties throughout Florida, under the management of The J. G. White Management Corporation, New York, N. Y. He assumed his new duties January 1. Mr. Andrews graduated from Purdue University, Lafayette, Ind., in 1908, receiving the degree of B. of S. in E. E. After graduation, he entered the employ of the Public Service Corporation of New Jersey, serving in the meter department of that company. In 1909 he became connected with the North Carolina Public Service Company. Soon after joining this organization he was appointed superintendent of the light and power department; later on he was made departmental manager of new business; in 1911 he was promoted to the position of assistant general manager, in charge of electric, gas and street railway utilities in Greensboro and High Point, N. C., and in 1917 his position was made assistant to the president and chief engineer. In connection with his general duties, Mr. Andrews has devoted much time with success to studying the question of rates and their application. He is a member of the American Institute of Electrical Engineers and of the American Gas Institute.

FRED R. FARMER, who for the past year has been sales manager of the Gibson Company, an Indianapolis (Ind.) automobile supply house, has been elected president and general manager of the Beardslee Chandelier Manufacturing Company, of Chicago. Mr. Farmer is a veteran in the electric-fixture field. Previous to his connection with the Gibson company he was for many years with the Beardslee company, advancing to the position of vice-president and manager. When leaving Chicago for Indianapolis last year, Mr. Farmer retained an interest in the Beardslee organization and was a director of the company. Mr. Farmer assumed his new duties on January 1 Frank S. Beardslee, former president, becomes chairman of the board of directors, and Robert Schrumpf retires as vice-president. Mr. Beardslee has not been very active in the company for the past few years, spending most of his time in California.

Fred R. Farmer.

W. J. CANADA, who recently severed his connection with the Bureau of Standards to become associated with the American International Shipbuilding Corporation, 140 North Broad Street, Philadelphia, has long been active in electrical and allied industries.

His work with the Bureau, which covered a period of four years, has been in the nature of a great co-operative undertaking through which the National Electrical Safety Code has been prepared and developed. His activities in that direction have been concerned with electrical safety and fire prevention engineering. During those four years the Safety Code, through Mr. Canada and with the co-operation of all interested, has been developed and has been adopted or recommended by at least 30 state commissions, besides numerous cities, insurance organizations and others. It is also voluntarily in use by many utilities and industrial concerns. Special committees were appointed by practically all the national associations interested in rules for electrical practice and in connection with this and other allied work of the Bureau of Standards on matters of electrical practice, Mr. Canada has been a member of the Electrical Committee of the National Fire Protection Association and Chairman of the Subcommittee on Farm Lighting Systems. He is an Honorary Life member of the International Association of Municipal Electricians, a past president of the Western Association of Electrical Inspectors, a member of the Electrical Council of Underwriters' Laboratories, a member of the Standardization Committee of the United States Employees' Compensation Commission, of the Accident Prevention Committee of the National Electric Light Association, of the National Joint Committee on Overhead Line Construction and many other organizations. These affiliations Mr. Canada expects to continue to the extent that his new duties will permit or require.

After completing high school at New Haven, Conn., which included extra courses in surveying, old English and

W. J. Canada.

botany, Mr. Canada entered Sheffield Scientific School of Yale University, New Haven, completing a course in electrical engineering with extra surveying in the spring of 1902. On graduation he received the degree of Ph. B. in electrical engineering, electrical prize, general two-year honors and was elected to membership in Sigma Xi, the engineering honor society. From 1902 to 1903 he was in the testing department of the General Electric Company at Schenectady, N. Y., and following that filled many responsible positions in various capacities with electrical companies and others, among which were the Appleyard Electrical Interurban Lines of Ohio, the Ohio Inspection Bureau, Standard Oil Company, Rocky Mountain Fire Underwriters' Association, etc., and has written and presented many valuable technical papers dealing with important electrical subjects and public safety as affected by electrical applications. Many of these papers have been published from time to time in prominent electrical journals, including the ELECTRICAL REVIEW.

Ivor L. Kentish-Rankin has resigned from the position of testing engineer with the Commonwealth Edison Company, Chicago, Ill., to become associate

I. L. Kentish-Rankin.

editor of the ELECTRICAL REVIEW. Mr. Kentish-Rankin is of English birth, and a Londoner, who combines an European education with a cosmopolitan experience, for he has traveled the chief countries of Europe to Italy and Egypt. His American experience comprises a number of years in Canada during which time he was "on the road." This work included the Westminster-Chilliwack electrification, including transmission lines, substations and trackage for what at that time was the longest interurban electric road in the country; hydro-electric extensions, development of the outdoor substation, and general distribution in the mineral and coal regions of British Columbia; and the electrification of the Canadian Pacific and Grand Trunk Railways' coal docks at Fort William and the Sault Ste. Marie steel mill of the Algoma Steel Corporation. For the last five years Mr. Kentish-Rankin has been identified with the Testing Department of the Commonwealth Edison Company, where he has been engaged in research of materials and methods, the solution of engineering and operating problems and the development of specialized apparatus. During the last two years he has devoted particular study to the economical utilization of fuels, and the low-temperature carbonization of coal

Obituary.

JOHN HENRY GOEHST, for many years construction superintendent of the Commonwealth Edison Company, and the oldest employe, in length of service, of that company, died at his home, 4810 Dorchester Avenue, Chicago, at 8:00 a. m. on New Year's Day. Death came as the result of a long illness. In March, 1917, Mr. Goehst underwent a severe surgical operation in the hope of obtaining relief from an internal trouble. He was a patient in St. Luke's Hospital for months at a time, always under the care of his devoted wife. Henry Goehst was in truth one of the electrical pioneers. He was born in Chicago on January 19, 1864. He attended the public school of Chicago and in 1881 went to work for H. M. Wilmarth & Brother, the predecessors of the present T. W. Wilmarth Company, perhaps the oldest lighting-fixture house in Chicago. For a time the boy was in the service of Leonard & Izard, who were western agents for the Edison electric lighting apparatus in the eighties. On December 5, 1882, Mr. Goehst secured employment with then recently organized Western Edison Light Company as a fixture-hanger or fixture-hanger's apprentice. From that day to the day of his death he had been continuously employed by the Western Edison Light Company and its successors, the Chicago Edison Company and Commonwealth Edison Company. He had been 35 years in the service and possessed a service badge studded with two rubies and bearing the insignia of four stars to indicate this length of service. Mr. Goehst had a wide acquaintance along electrical men not only in Chicago and the West but all over the United States. He obtained much of his early training under Luther Stieringer, the great Edison decorative-lighting and fixture expert of the early days. Mr. Goehst was made construction superintendent of the old Chicago Edison Company when but twenty-three years old, and during his administration the department experienced great growth and now employs about 675 men.

Mr. Goehst was very loyal to his company and was ingenious and persevering. He had taken out a number of patents, mainly relating to electrical construction work. He became interested in concerns closely connected with the electric central-station

John Henry Goehst.

industry and he was one of the organizers of the Federal Electric Company and at the time of his death was president of the Federal Sign System (Electric), the successor of that company. He was also treasurer of the Minerallac Electric Company. He was a member of the committee in charge of the Employes' Savings Fund of the Commonwealth Edison Company. He was also an associate of the American Institute of Electrical Engineers, a member of the Jovian Order, of the Chicago Athletic Association, the Kenwood Club and the South Shore Country Club.

Current News

Weekly Record of Construction Activities—Conventions

EASTERN STATES.

HUDSON, MASS.—City council considering plans for increasing the output of the municipal electric-light plant to meet the increasing demands for electrical service.

PALMER, MASS.—Wright Wire Company plans to build a power house, to generate 9000 horsepower. This will operate the complete plant and assure the rolling mill power also without interruption. Other improvements and developments will be made also. Address George W. Wright, president, Worcester, Mass.

ANDOVER, N. Y.—Town officials are planning the construction of a municipal electric-lighting plant. Harry Craig, County Superintendent of Highways, Canaseraga, N. Y.

BROOKLYN, N. Y.—Until January 7, bids will be received by the United States Government, Bureau of Yards & Docks, Washington, D. C., for the construction of a new superstructure to its power house No. 2585 at the local navy yards. F. R. Harris is chief.

BUFFALO, N. Y.—City Council is planning for an appropriation of $10,000 for the purpose of securing the services of electrical engineers to determine the best plan for the development and distribution of more power at Niagara Falls. Recommendations have also been made providing that a report be drawn up by the city engineer showing comparatively the electric power developed at the Falls by Canadian and American plants, relative cost to consumers of power here and in Canada, and the general plan of distribution.

BUFFALO, N. Y.—New York Central Railroad Company has taken out a building permit for the immediate construction of a power house in Curtiss Street, to cost about $20,000.

DUNKIRK, N. Y.—Improvements are being made to municipal electric-light plant, including the installation of a frequency changer, to use Niagara power in connection with the power generated at municipal plant.

HORNELL, N. Y.—Village has applied to public service commission for permission to build a large electric light plant to supply the community with electric light and power.

IRONDEQUOIT, N. Y.—Department of Public Works, City Hall, Rochester, has completed plans for the erection of a one-story brick, stone and steel power house, about 40x80 feet, at Irondequoit. R. H. Pierce, Commissioner.

NEW YORK, N. Y.—Manhattan Storage Battery Company has incorporated with a capital of $9,900 to manufacture storage batteries and kindred products. Incorporators are E. J. Stern, A. J. Picard and A. Hirst, 2008 Broadway.

NEW YORK, N. Y.—New York Edison Company, 130 East Fifteenth street, has awarded a contract to the Louis Weber Building Company, 171 Madison avenue, for the construction of a one-story addition to its brick transformer station on Park avenue, near One Hundred and Eighty-ninth street, and a one-story storehouse at the same location. Estimated cost, $15,000.

NEW YORK, N. Y.—E. Greenebaum Company, 349 East One Hundred and Third street, has awarded a contract to the W. K. Moran Company, 405 Lexington avenue, for the installation of power equipment and heating system in its new packing house at 320 East One Hundred and Third street.

QUEENS, N. Y.—Atlantic Electric Goods Company has incorporated with a capital of $50,000 to manufacture electrical appliances. Incorporators are J. J. Wesley, P. J. Sheeley and C. L. Eidlitz, New York.

SYRACUSE, N. Y.—New York Central Railroad Company, West Onondaga street, has awarded a contract to W. M. Ballard, Oneida, for the erection of a one-story power house, about 25x35 feet, at its West street yards.

WATERTOWN, N. Y. — City having plans prepared by S. M. Green Co., architects, 293 Bridge street, Springfield, Mass., for a power plant; estimated cost, $300,000. J. W. Knowlton, president of water board.

CAMDEN, N. J.—City Council has approved appropriations of $96,500 and $13,900 for its electric lighting and electrical bureau, respectively, for 1918.

DOVER, N. J.—Board of Public Utility Commissioners has granted permission to the New Jersey Power & Light Company to dispose of certain of its property valued at $99,562. The holdings will be sold at a price of $22,900, the resulting loss being carried on the company's books as a property abandoned account.

GLOUCESTER, N. J.—Bell Telephone Company, 1230 Arch street, Philadelphia, Pa., has had plans prepared for the erection of a two-story brick local exchange plant, to provide for increased capacity.

HADDONFIELD, N. J.—The erection of a municipal electric light plant on a site on Evans Pond is under consideration by the City Council. The construction of a concrete dam, spillway and bulkhead, which makes this body of water available, has been completed.

MORRISTOWN, N. J.—Morris County Traction Company, Park place, has been granted the approval of the Board of Public Utility Commissioners for the issue of bonds for $1,179,000 to provide for improvements, extensions, etc.

MORRISTOWN, N. J.—Morris & Somerset Electric Company, 20 South street, has been awarded a contract for furnishing power for the operation of the proposed new aluminum bronze plant to be erected by Charles Butters, of Oakland, Cal., on a site recently acquired at the junction of the main line of the Morristown & Erie Railroad with the Malapardis branch.

MORRISTOWN, N. J.—Board of Aldermen is planning an appropriation of $17,800 for street lights for the year 1918.

NEWARK, N. J.—Butterworth-Judson Company, Avenue R, has taken out a building permit for the construction of a power house, about 87x94 feet, at its works on Roanoke avenue. Plans for the structure, which will cost about $24,000, are being prepared.

NEWARK, N. J.—Board of Freeholders is planning for the immediate installation of new heating equipment including new boilers at the Essex County Hospital, Overbrook. Improvements in the electric lighting system will also be made.

SKILLMAN, N. J.—Philadelphia & Reading Railroad Company, Twelfth and Market streets, Philadelphia, Pa., has perfected arrangements for the erection of its new local power house and signal tower. The structures will be two-story brick, concrete and steel, about 20x20 feet, and one-story and basement, brick, concrete and steel, about 15x33 feet, respectively. Samuel T. Wagner, Reading Terminal, Philadelphia, Pa., is the architect.

TRENTON, N. J.—Board of Freeholders has awarded a contract to the Public Service Corporation, for furnishing service for the lighting of bridges on the following streets: Lee and Olden avenue, Chambers and Southard streets and Perdicaris place. The contract is for a period of five years.

TRENTON, N. J.—City Commission is considering the extension of its electric street-lighting system in Dexter, Nassau and Vine streets and Phillips avenue, in the North Trenton section.

BIRDSBORO, PA.—Town Council has awarded a contract to the Birdsboro Electric Company for supplying service for its electric street-lighting system at the rate of $21.50 per lamp per year for a period of five years.

BRADFORD, PA. — Kendall Refining Company has awarded a contract to W. I. Unruh, 574 East Main street, Bradford, for the erection of a two-story power house, about 40x75 feet, at its plant in the East Bradford section.

CARLISLE, PA.—At a recent meeting of local manufacturers, arrangements were perfected whereby the necessity of shutting down local plants due to the shortage of coal was averted. The plan calls for a more equitable distribution of electric current, making it possible for the Carlisle Light, Heat & Power Company to operate at maximum capacity and also save a quantity of coal daily.

ERIE, PA.—General Electric Company has awarded a contract to the Henry Shenk Company, Twelfth and Sassafras streets, Erie, for the erection of a power house at its local plant.

HARRISBURG, PA.—Rapid progress is being made in the installation of underground conduits to replace the present overhead wires of the police and fire alarm systems in Third and Market streets. As soon as sufficient cable can be obtained this work will be extended from police headquarters to Court street and northerly to Liberty street.

HAZLETON, PA.—Wilmot Engineering Company, Markle Bank Building, has had plans prepared for the construction of new additions to its plant at White Haven, including several power stations, machine shop, and other shop structures. The company specializes in the manufacture of breaker and mining machinery of all kinds. George W. Wilmot is president.

NANTICOKE, PA.—The State Hospital is having plans prepared for the erection of additions to the institution, including a one-story brick power house. McCormick & French, Second National Bank Building, Wilkes-Barre, are the architects. Dr. E. D. Meyer, West Washington street, Nanticoke, is superintendent.

NEW CASTLE, PA.—Mahoning & Shenango Railway & Light Company has been compelled to suspend service to all large power consumers throughout the Elwood, New Castle, Sharon and Youngstown, Ohio districts, for the purpose of conserving fuel for transportation, street lighting and residential use. This has seriously affected a number of industrial plants, and thousands of workmen have been thrown out of work.

NORRISTOWN, PA.—United Telephone & Telegraph Company is making improvements in its local plant, including the installation of a new switchboard.

PHILADELPHIA, PA.—Shane Brothers & Wilson Company, Bourse Building, is having plans prepared for the construction of a power house at its plant at Sixty-third and Market streets. The structure will be one-story, brick and concrete, about 33x40 feet. J. M. Whitham, Philadelphia, is the architect.

POTTSVILLE, PA.—The Pottsville Union Traction Company has filed notice with the Public Service Commission of the issuance of bonds to the amount of $10,000 for improvements, etc.

POTTSVILLE, PA.—Notice has been filed with the Public Service Commission by the Eastern Pennsylvania Light, Heat & Power Company, of a bond issue for $10,500, for improvements, etc.

READING, PA.—Reading Transit & Light Company has filed notice with the Public Service Commission that arrangements have been perfected for an appropriation of $150,000 for improvement, extensions, etc.

STEELTON, PA.—Borough officials are making rapid progress in the installation of new police telephones and the improvement of the police alarm system. It is expected that the work will be completed by January 1.

BALTIMORE, MD.—Bartlett-Hayward Company, Scott and McHenry streets, has awarded a contract to Morrow

Brothers, Fidelity Building, Baltimore, for the erection of a new transformer house at Ramsay and Poppleton streets.

BALTIMORE, MD.—Poole Engineering & Machine Company is making rapid progress in the construction of its two-story electric substation at Woodberry, near Baltimore. The structure will be about 30x155 feet, and will cost $15,000. H. D. Watts, Garrett Building, Baltimore, is the contractor.

BALTIMORE, MD.—Corkran, Hill & Company, 221 South Howard street, are having plans prepared for the erection of a power house at their plant on Sixth street, near Wilkens avenue. Gardner & Lindberg, Chicago, Ill., are architects and engineers.

WASHINGTON, D. C.—Chesapeake & Potomac Telephone Company, Thirteenth and G streets, N. W., is planning for the construction of a new telephone building on Thirteenth street to cost about $800,000. McKenzie, Voorhees & Gmelin, 1123 Broadway, New York, are the architects.

HOPEWELL, VA.—City is planning for a bond issue for $75,000 to provide for the erection of an electric-light plant and water and sewerage systems.

CHARLESTON, W. VA.—West Virginia Water & Electric Company is planning to increase its capital by $1,000,000 to provide for expansion.

WHEELING, W. VA.—Beech Bottom Power Corporation has incorporated with a capital of $400,000, to operate a local plant. The incorporators are George F. Jebbett and Allen E. Moore, of New York; Alfred F. McCabe, F. H. Bulethorn and S. C. Dood, of Brooklyn, N. Y.

GRAPHITEVILLE, N. C. — General Graphite Company, Jefferson Bank Building, Birmingham, Ala., will construct a hydroelectric plant.

ATLANTA, GA.—City is considering constructing electric generating station at garbage crematory at cost of $60,000 to $70,000, to use refuse as fuel. E. R. Turner, city electrician.

NORTH CENTRAL STATES.

CLEVELAND, OHIO.—Fowler Worman Kelley Company, Hippodrome Building, has organized the Silver Lake Improvement Company, located east of Cuyahoga Falls, Ohio, and the property formerly known as the Silver Lake Park, has been acquired. The new company will improve the park, using the property for high-class residences for residents of Akron and an up-to-date sewer system, electric lighting system, etc., will be installed.

CLEVELAND, OHIO.—Storage Battery Rebuilding Company has incorporated with a capital of $15,000. The incorporators are Henry L. Beggs, Samuel L. Bowlus, Lawrence C. Meyer, Arthur W. Longbarger and Gilbert J. Spencer.

CAIRO, ILL.—Electric Manufacturing Company has incorporated with a capital of $550,000. Henry Tideman, Charles M. Roos and James H. Galligan are the incorporators.

CENTRALIA, ILL.—Southern Illinois Light & Power Company has taken over the utility plants at Centralia and will make that city a distributing center for all supplies and accounts of various utility plants operated by the company. The plants which will be subsidiary to Centralia will be those at Mount Vernon, DuQuoin, Chester, Sparta, Collinsville, Litchfield, Hillsboro and Nashville.

CHICAGO, ILL. — Benjamin Electric Manufacturing Company, 128 South Sangamon street, has increased its capital from $200,000 to $3,000,000; the number of directors has also been increased.

HOMER, ILL.—J. M. Copel and T. E. Hughes of Champaign, Ill., have purchased the plant of the Homer Light & Power Company and will operate it after January 1. This plant also furnishes light to Sidney, Ill.

MATTOON, ILL.—Central Illinois Public Service Company has petitioned the Illinois Public Utilities Commission for permission to abandon the heating plants operated by the company at Carrollton, Charleston, Moweaqua, Virden and White Hall. The petition is based upon the high cost and scarcity of coal especially, as well as the high costs of other materials, making the heating service in the towns mentioned unprofitable.

ROCKFORD, ILL.—Rockford Electric Company is equipping its former power plant at the corner of Wyman and Chestnut streets as an auxiliary heating station.

DATES AHEAD.

American Institute of Consulting Engineers, Inc. Annual meeting, January 14. Secretary, F. A. Molitor, 35 Nassau Street, New York City.

Electrical Contractors' Association of State of Missouri. Annual convention, January 19. Secretary, A. J. Burns, 318 West Tenth Street, Kansas City, Mo.

Minnesota Electrical Contractors' Association. Annual convention, Minneapolis, Minn., January 21. Secretary, G. M. Jones, 112 South Seventh Street, Minneapolis.

Northern White Cedar Association. Twenty-second annual meeting, Hotel Radisson, Minneapolis, Minn., January 22-23, 1918. Secretary, N. E. Boucher, 743 Lumber Exchange, Minneapolis.

Western Association of Electrical Inspectors. Annual meeting, Memphis, Tenn., January 29-30-31. Secretary, W. S. Boyd, 175 West Jackson Boulevard, Chicago, Ill.

Illinois Electrical Contractors' Association. Semi-annual convention, Chicago, February 1918. Secretary-Treasurer, L. B. Van Nuys, 238 South Jefferson Avenue, Peoria, Ill.

Vermont Electrical Association. Annual meeting, February, 1918. Secretary-Treasurer, C. H. West, Rutland, Vt.

National Association of Electrical Inspectors. Annual convention, New York, March, 1918. Secretary-Treasurer, William L. Smith, Concord, Mass.

Wisconsin Electrical Association. Annual meeting, March, 1918. Secretary, George Allison, 1410 First National Bank Building, Milwaukee, Wis.

Southwestern Society of Engineers. Annual meeting, April, 1918. Secretary, C. E. Barglebaugh, 703 First National Bank Building, El Paso, Tex.

Kentucky Association of Electrical Contractors. Annual meeting, May, 1918, Louisville, Ky. Secretary, F. F. Valinoti.

Texas State Association of Electrical Contractors. Annual meeting, Galveston, Tex., June 15, 1918. Secretary, H. S. Ashley, Fort Worth, Tex.

Georgia Electrical Contractors' Association. Annual meeting, June, 1918, Tybee Island, Ga. Secretary, Dan Carey, Atlanta Builders' Exchange, Atlanta, Ga.

SPRINGFIELD, ILL.—The Public Service Company of Northern Illinois has been authorized by the Illinois Public Utilities Commission to purchase and operate the plant of the Stark County Electric Company.

WAYLAND, MICH.—Wayland Electric Light & Power Company has incorporated with a capital of $5,000, to furnish heat, power and light for Wayland. The stockholders are L. B. Mason, E. O. Hanlon and A. E. Weaver.

ANTIGO, WIS.—Electric Farm & Lighting Power Company has incorporated with a capital of $25,000. The incorporators are R. P. Brown, J. T. Brown and John H. Walechka. The company has asked permission to conduct a general business of dealing in individual or isolated lighting or power plants, or systems, installing or operating the same and also to deal in electrical machinery, supplies, devices and appliances and other appurtenances convenient for sale in connection with the business. Previous to incorporation the company operated here as the Delco Power & Lighting Company.

ST. PAUL, MINN.—Great Northern Railroad will erect automatic block signals in sections of Montana in 1918.

IOWA CITY, IOWA.—A $15,000 hydraulic experiment station will be erected across the river near the west end of the large dam.

ST. LOUIS, MO.—An ordinance has been introduced into the Board of Aldermen requiring the Union Electric Light & Power Company to replace all 32-candlepower lamps with 60-watt Mazda of 58 candlepower.

TOPEKA, KANS. — North American Hotel Company is contemplating the construction of a 10-story hotel building at Ninth street and Kansas avenue, to cost $500,000. Arthur W. Gross and William Johnson, Omaha, Neb., are representatives.

FALLS CITY, NEB.—The City Council is considering calling an election to submit the proposal to issue $75,000 in bonds for remodeling the municipal electric light plant.

OCONTO, NEB.—Election will soon be held to vote bond issue of $3800 for municipal electric lighting plant.

LESTERVILLE, S. D.—Town board has accepted the proposition of Otto S. Oleson to install an electric lighting system here, to cost $8,000, and when completed will make Lesterville one of the best lighted towns in the state.

DRAKE, N. D.—T. E. Sleight has sold the local electric lighting plant to the municipality, the price being $8,124. Starting January 1, a 24-hour service will be maintained.

SOUTH CENTRAL STATES.

WHITESBURG, KY.—W. C. Daniels & Son are planning to extend their electric system by the construction of a transmission line to Mayking, a distance of about five miles.

FOUNTAIN CITY, TENN.—Plans are being considered for the installation of an electric lighting system in Fountain City.

MOBILE, ALA. — Contract has been closed between the Mobile Electric Company and the Chickasaw Shipbuilding Company, the latter a United States Steel Corporation subsidiary, for a 400-horsepower circuit five miles in length, for power and lighting at Chickasaw.

BELTON, TEX.—The property of the Southwestern Traction Company, including the interurban line which runs between Belton and Temple, has been sold under an order of the United States court, the purchaser being F. W. Downs, of Temple, the consideration, including the mortgage bonds, being $170,000. It is stated that the company will be reorganized and important improvements will be made to the property.

FORT WORTH, TEX.—Fort Worth Power & Light Company plans to install additional machinery in its electric light and power plant.

NACOGDOCHES, TEX. — City Council will purchase and install a 300-kilowatt, 400-horsepower, 2300-volt steam turbine and generator in the municipal electric light and power plant at a cost of about $14,000.

NORTH FORT WORTH, TEX.—North Fort Worth Ice & Cold Storage Company will install additional machinery in its plant here for the purpose of adding about one-third to its capacity.

Orange, Tex.—International Shipbuilding Company will install a large electric carrying and mono-rail system in its shipbuilding yards here.

UVALDE, TEX.—Uvalde Electric & Ice Company will install additional machinery in its plant for the purpose of providing power for operating irrigation pumps and the machinery of industrial plants.

WESTERN STATES.

REDSTONE, MONT. — The lighting plant here will be rebuilt and made into one of the best in this part of the state, according to S. J. Dorothy, who is seeking to interest local capital in the proposition.

CARLSBAD, N. M.—Carlsbad Light & Power Company has been incorporated with a capital stock of $150,000 for the purpose of constructing an electric light and power plant here. The incorporators are Mary E. Tansell of Olympia, Wash., Herbert W. Tansell and Helen S. Tansell of Carlsbad.

SHELLEY, IDA.—An electric lighting system is being planned for this place.

EVERETT, WASH. — Norway-Pacific Construction & Dry Dock Company, of Seattle, will construct a $1,000,000 shipyard and dry dock in Everett. M. G. Thomle, president, Seattle.

PORTLAND, ORE.—Resolutions praying that the Oregon Public Service Commission take action to relieve the Portland Railway, Light & Power Company from its present embarrassment by granting an increased fare or otherwise, and to enable the maintenance of the present scale of hours and wages for car men, have been unanimously adopted by the general committee from civic clubs of

Portland. The request was based upon investigations by duly appointed committees.

SEATTLE, WASH.—An ordinance authorizing the board of works to call for bids for a completed hydroelectric plant, together with a transmission line and a substation in the city limits and providing for a $5,000,000 bond issue, will be introduced at a special meeting of the City Council. Address A. H. Dimock, city engineer.

SEATTLE, WASH.—City Council has authorized erection of a substation for the lighting department in Gilman Park addition, to cost $20,000.

SEATTLE, WASH.—Clyde Equipment Company at $7,681 was awarded contract for 12,406 feet of relay rails and 406 pairs of fish plates for the city municipal lines.

SEATTLE, WASH.—Corporation Counsel Hugh M. Caldwell and S. D. Ross, superintendent of lighting, will go to Washington at once, unless otherwise directed by the Government, to represent the city in its application for a permit to construct a hydroelectric plant in the Washington national forest. Upon their return if the permit is issued the Board of Public Works will call for bids for a completed plant on the federal domain, a transmission line and substation in the city limits to cost not more than $5,000,000. The particular site on which the city desires to obtain rights is on the Skagit River and the ordinance limits the bidders to a hydroelectric plant on the federal domain. In case it is found advisable later to consider bids for plants outside the federal domain the ordinance may be amended in this particular. The new ordinance is an amendment of an earlier ordinance authorizing a $3,000,000 bond issue for a completed hydroelectric plant and transmission line alone. It is now provided that the water supply serving the plant shall be sufficient in amount to insure the generdtion and delivery of about 18,000 kilowatts odf continuous energy and shall also be sufficient to secure the generation and delivery of 25,000 kilowatts for a period of five hours each day.

SEATTLE, WASH.—Plans are being prepared for the construction of a substation for the city lighting department at West 49th street and 14th avenue, N. W., one and two stories high, 66x66 feet. The estimated cost is $75,000. Daniel Huntington, city architect.

SEATTLE, WASH.—Puget Sound Traction, Light & Power Company has the work of installing the additional penstock at its White River hydroelectric plant about three-fourths completed. The foundations have been placed for the 16,000 kilovolt ampere generator and water wheel. Delivery of this equipment is expected early in January.

SEATTLE, WASH.—Skykomish River Power Company has offered to the city of Seattle a power site on the Stillaguamish River, said to be capable of producing 40,000 horsepower, for the sum of $800,000.

SEATTLE, WASH. — The question of utilizing the $375,000 yet remaining of $800,000 in bonds authorized in 1911 for the purchasing or paralleling of the Seattle & Rainier Valley electric line, for construction of an elevated railway on Railroad and Whatcom avenues from Washington street to Spokane street will be submitted to the voters on March 6.

OMEMEE, ONT., CANADA—City plans to install a hydroelectric power plant. Estimated cost, $9000. W. H. Kennedy, clerk.

PARKHILL, ONT., CANADA — The town plans to build a hydroelectric power plant. Estimated cost, $12,000.

LOS ANGELES, CAL.—Mayor Woodman has outlined a plan whereby it may be possible to provide funds to complete the city's power plant No. 2, thus opening the way for the early generation of 25,000 additional horsepower. The mayor said the sinking fund could be utilized to buy a block of the $1,020,000 Hollywood water bonds, thus releasing a large amount of public service commission funds to start the work.

LOS ANGELES, CAL.—The mayor is seeking means to finance the building of a second power plant, estimated to cost $750,000. Address E. F. Scattergood, chief engineer of Power Bureau.

SAN FRANCISCO, CAL.—Pacific Gas & Electric Company has filed application for permission to issue $3,000,000 general and refunding 5 per cent gold bonds.

INCORPORATIONS

JERSEY CITY, N. J.—Dodd William Manufacturing Company, Inc. Capital, $250,000. To manufacture electrical devices of various kinds. Incorporators: Josiah Dodd, Charles E. Corbin, and Edward A. Markley, 243 Washington Street, Jersey City.

NEWARK, N. J.—New York Electric Rectifier Corporation. Capital, $50,000. To manufacture electrical apparatus. Incorporators: George W. Downs, Madison; James M. Clark, East Orange, and Frank E. Richards, Glen Ridge.

YONKERS, N. Y.—The A. & C. Manufacturing Company. Nominal capital, $9,000. To manufacture electrical and gas appliances. Incorporators: M. and E. J., and C. R. Abraham, Yonkers.

PORT ARTHUR, TEX.—Port Arthur Telephone Company. Capital, $100,000. Incorporators: R. S. Shipley, J. W. Williams and P. K. Higgins.

SHELTON, WASH.—Goldsborough Telephone Company. Capital, $1,500. Richard M. Haydon.

CLEVELAND, OHIO.—Cleveland Controller & Manufacturing Company has been incorporated with a capital stock of $20,000. L. C. Spieth, L. A. O'Neil, N. M. Strine, M. E. Gleason and M. G. Egan are the incorporators.

NEWARK, N. J.—N. Dickinson Company, 367 High street has been organized to manufacture lighting specialties. N. Dickinson is the organizer.

AMHERST, WIS.—Amherst Electric Service Company has incorporated with a capital stock of $25,000. B. E. Dwinell, Hugh Evans and others are incorporators.

NEW YORK, N. Y.—The Railway Utilities & Export Company has incorporated with a capital stock of $10,000 by F. H. Martinell, H. C. Niemeyer and G. A. Reiss.

LOS ANGELES, CAL.—B. B. Bell Company has incorporated with a capital stock of $30,000 to manufacture lighting fixtures, etc. The incorporators are B. B. Bell, E. P. Bell and D. S. Collins.

WILMINGTON, DEL.—Mountain States Power Company has incorporated with a capital stock of $15,000,000 to generate and distribute electricity for lamps, heaters and motors. The incorporators are C. L. Rimlinger, M. M. Clancy, Clement M. Egner.

IOLA, WIS.—Iola Light & Power Company has incorporated with a capital of $25,000 and will erect and operate a hydroelectric and an auxiliary steam-generating plant, saw and planing mill and other industries. E. J. George, Bertha and Erna Nehls are the incorporators.

NEWARK, N. J.—New York Electric Rectifier Corporation has incorporated with a capital of $50,000, to manufacture electrical apparatus. James M. Clark, George W. Downs and Frank E. Richards are the incorporators.

PROPOSALS

POWER DAMS.—The Alberta Hydro-Electric Company, Limited, of Calgary, Alberta, Canada, will receive bids for a series of dams for power development along the Bow River. Zeph Malhoit, Box 1480, Calgary, is consulting engineer of the company.

SPRINKLER SYSTEM AND CENTRIFUGAL PUMPS.—Sealed bids will be received by the Board of Commissioners, 200 New Orleans Court Building, New Orleans, La., January 9, for furnishing and installing a complete fire protection and sprinkler system, including motor-driven centrifugal underwriters' pumps and complete electrical installation for same for portions of the cotton warehouses and terminal now under construction for the Board. Address W. B. Thompson, president.

ELECTRIC LIGHTING SYSTEM.—Bureau of Yards and Docks, Navy Department, Washington, D. C., will receive sealed and indorsed proposals January 14 for electric lighting system for extension of machine shop building No. 128 at the Navy Yard, New York City. Drawing and specifications No. 2728 may be obtained on application to the Bureau or to the commandant of the navy yard named. A. L. Parsons, acting chief of Bureau.

ELECTRIC LIGHT AND POWER WIRING.—The Board of Freeholders, Newark, N. J., will receive bids until January 9 for the furnishing and installation of new electric light and power wiring in the laundry of the Essex County Hospital, Overbrook. August L. Lacombe, chairman, Committee on Public Buildings.

TOWERS AND TANK.—Bureau of Yards and Docks, Navy Department, Washington, D. C., will receive bids until January 21 for installing towers and tank at Bartaria Bay, to cost $35,000. Address A. L. Parsons, acting chief.

NEW PUBLICATIONS

SAVING COAL IN THE HOME HEATING PLANT.—The State Council of Defense, State of Illinois, has issued a useful 4-page folder explaining some of the things householders and small heating-plant operators can do to save coal and, secondly, save money by obtaining more useful heat from a given quantity of fuel. The subject matter has been abstracted from Circular 4 of the Engineering Experimental Station, University of Illinois, and deals with the coals most easily obtained in Illinois, namely from Illinois, Kentucky and Indiana. Questions and practices are first taken up such as the effect of air leakage through doors, ash pits, cracks, defective dampers, etc., and later the matter of damper control and manipulation and the factors to be guarded against that come gradually from deterioration of equipment. Considerable advice as to the choice of equipment, how best to install it and what to prevent in its maintenance follow, with information on chimneys and their layout, the need for efficient covering and maintenance of steam and heating pipes. The properties of Illinois, Kentucky and Indiana coals are then taken up, with suggestions how best to burn it, what to do and what not to do, for obtaining maximum fuel economy, greatest heat value and least smoke. Copies of the original paper, entitled "The Economical Purchase and Use of Coal for Heating Homes with Special Reference to Conditions in Illinois," may be obtained by enclosing 10 cents with application to the Engineering Experimental Station, University of Illinois, Urbana, Illinois.

TERRESTRIAL MAGNETISM AND ATMOSPHERIC ELECTRICITY. — The international quarterly journal, published for the Johns Hopkins Press, Baltimore, and the Abingdon Press, Cincinnati, Ohio, known as Terrestrial Magnetism and Atmospheric Electricity, in its December quarterly publishes a number of valuable articles and tables, with the following titles and authors: On The Magnetic and Electric Fields Which Spontaneously Arise in a Rotating Conducting Sphere, by W. F. G. Swann; Latest Annual Values of the Magnetic Elements at Observatories, by J. A. Fleming; The Radium Content of Sea-Salt Specimens Collected on Cruise IV of the Carnegie, by C. W. Hewlett; Magnetic Observations at the Samoa Observatory During the Solar Eclipse of August 21, 1914, by G. Angenheister; Observations Made on the Carnegie During Her Sub-Antarctic Cruise, December 6, 1915, to April 1, 1916, by J. P. Ault; Announcement of British Association Meetings for the Discussion of Geophysical Subjects, by S. Chapman, and notes on magnetic, electric and allied observations during the total solar eclipse on June 8, 1918, and from Millikan's "The Electron," also a list of recent publications dealing with magnetic subjects.

Financial News

BANKING SYSTEM STANDS HARD TEST.

BY LUCIUS TETER,

President, Chicago Savings Bank & Trust Company, and President, Chicago Association of Commerce.

The experiences of 1917 have given our financial system the most severe test it has had in the history of the country. That we have stood the test and come through the year without any financial disaster can be credited to three things:

First, the successful operation of our federal reserve system.

Second, the unusual natural resources of the country, and,

Third, the wonderful spirit of loyalty and co-operation on the part of the American people.

The banking system has had to finance crops, manufacturing and other commercial activities on a higher cost basis than ever before. The outstanding financial events of the year, however, were the placing of the first and second Liberty Bond issues of $2,000,000,000 and $3,808,766,150, respectively. The Government has received full payment for the first issue. When it is borne in mind that no such sums as these had ever been handled in American finance before, and, further, that these great sums have been handled through the American banking system without seemingly a shadow of strain, some idea may be gained of the strength and ability of our present banking system.

A development of the future is that bankers and people alike must learn that the war is to be paid for from current savings. Drawing money previously saved from the bank for the purpose of paying for government bonds does not add to the sum total of money strength in the country. Neither does it accomplish a patriotic good to subscribe for a government bond and borrow the money to pay for it unless such borrowing is temporary and calculated to be taken up by savings.

Again, the public should understand that the banks must not be depended upon to take the bonds and carry them indefinitely in strong boxes, because, just to the extent that the banks, and in turn the federal reserve banks, fill up with government bonds, or loans on the same, the banking strength of the country is reduced.

I have very great confidence that our banking system will carry us through the financial stress and strain of the war period that is ahead of us. The bankers will co-operate with the Government and with all merchants and manufacturers who are engaged in legitimate enterprises. There will be a disposition to discourage overexpansion, particularly along the lines of fixed investment, but a ready response for all legitimate demands of commerce and those activities calculated to help win the war.

I believe that when the war is over, among the many satisfactory reflections will be that our American banking system has at all times withstood the tests which have been put upon it, and that our American banker, like the good citizen that he is, has done his share toward winning the war.

Securities May Benefit by Government Railroad Control.

It is the consensus of opinion in the street that the taking over of the railroads by the government for the period of the war with the generous allowances as to compensation to the various companies ushers in a new era of good feeling and optimism toward securities generally. No banker or broker is rash enough to make any long range predictions as to the future course of security prices. Yet a canvass made of the banks and brokerage houses indicate a revival of confidence: a more hopeful view of things which promises much for the future of the market. The best feature of the whole situation now, according to one banker, is that investors will not be longer forced into selling their railroad securities through fear of a financial catastrophe. They are assured of their income for the period of the war.

Utility Securities Maturing in 1918 Show Big Increase.

Public utilities securities maturing during the coming year will reach the highest figure that has been touched in the last five years, according to compilations by eastern statisticians. The total amount in round numbers will amount to $210,500,000, an increase of more than $126,500,000 over the maturities for the year just ending. Notes running from one to five years comprise the greater portion of the issues which will fall due, as has obtained in the last few years. The $57,736,000 six-year 5 per cent notes of the Brooklyn Rapid Transit Company is the largest single issue to mature during the year. These notes, which become due July 1, are secured by a pledge with the trustee of $57,735,000 New York Municipal Railway Corporation first 5s and $10,000,000 Brooklyn Rapid Transit first and refunding convertable 4s. Commenting on this maturity, it is said that owing to the present state of the securities market it is doubtful if the company can sell securities at reasonable prices to pay off the notes, and it seems very likely that an extension of the notes will be arranged. Besides the $57,736,000 Brooklyn Rapid Transit notes other large items falling due are the American Telephone & Telegraph two-year 4½ per cent notes for $7,595,000 and associated companies 4½ per cent notes amounting to $10,591,000, which were indorsed by the American Telephone & Telegraph Company. Ample provision is said to have been made for meeting these issues when they fall due.

BONDS AND NOTES MATURING BY MONTHS.

Public utility bonds and notes maturing in January	$ 9,430,550
Public utility bonds and notes maturing February	32,278,500
Public utility bonds and notes maturing in March	9,790,500
Public utility bonds and notes maturing in April	13,257,900
Public utility bonds and notes maturing in May	25,947,200
Public utility bonds and notes maturing in June	11,395,600
Public utility bonds and notes maturing in July	80,558,500
Public utility bonds and notes maturing in August	10,824,900
Public utility bonds and notes maturing in September	4,102,200
Public utility bonds and notes maturing in October	7,260,400
Public utility bonds and notes maturing in November	2,081,000
Public utility bonds and notes maturing in December	3,500,530
Total public utility issues maturing in 1918	$210,427,780

What Our Industries Are Earning.

Par value of shares of stock has had some attention from the Treasury Department during the last year, in connection with the federal tax on capital stock taken at its fair value. The department has now published its conclusions regarding the net earnings corporations engaged in different kinds of business must make in order to have their stock worth its par value. The department's conclusions are that the following rates are necessary for this purpuose:

	Per cent.
Banking:	
States west of Mississippi river	8
States east of Mississippi river	6
Mercantile	10
Mining	10
Industrial	10
Oil-producing companies	15
Oil-refining companies	10
Contracting and construction companies	15
Public utilities	8
Railroads	8
Light and power companies	8
Electric railways	8

New Unification Plan of Adirondack Electric.

Directors of the Adirondack Electric Power Corporation notify stockholders of a new plan for joining the company's properties with the properties and business of the following companies: Schenectady Illuminating Company, Mohawk Gas Company, Schenectady Power Company, East Creek Electric Light & Power Company and Edison Electric Light & Power Company of Amsterdam. This is a substitute for the plan of January 27, 1917. The new plan must be approved by the Public Service Commission, second district of New York. If the plan is not consummated during 1918, depositors will have the right to withdraw their stock on or after December 31, 1918, without expense.

The Adirondack Electric Power Corporation is to join the above-mentioned properties with its own for the following consideration, subject to reservations: $6,500,000 bonds, $4,100,000 7 per cent preferred stock, $4,750,000 common stock.

Of the above preferred stock, which will be of the same class as the present outstanding preferred stock of the Adirondack Company, $2,300,000 is to be returned to the treasury of the company for future sale. This has the practical effect of substituting $1,800,000 of preferred stock for the larger amount tabulated above. This means by comparison with the original plan that the preferred dividend demands on the net earnings of the enlarged company will be less by $144,000 (the difference between 6 per cent on the $4,500,000 preferred of the original plan and 7 per cent on the $1,800,000 preferred above).

Holders of the present $2,500,000 6 per cent preferred stock of Adirondack Electric are to have a six months' option to exchange par for par for $2,500,000 of the enlarged company's 5 per cent debenture bonds (new ten-year issue); holders of such bonds are to have the further privilege of exchange, par for par, into 7 per cent stock of the same issue as the above, such privilege of exchange to begin two years and end three years from date of issue of such bonds, or for an earlier period of not less than one year, if that can be lawfully done, or the exchange into 7 per cent stock may be made direct by the 6 per cent preferred stockholders.

As set forward in the earlier plan, the common stock will be changed from $100 to $50, and each stockholder will then retain his present number of shares of the changed par value, but in a company with largely increased assets and business.

Should the unification be completed and the new stock and bonds be authorized and issued as planned, total issues in hands of the public would be:

To owners of above group of properties.		
Bonds	$ 6,500,000	5%
Preferred stock	1,800,000	7%
Common stock (par $50)	4,750,000	
Total	$13,050,000	

Adirondack securities now in hands of public.		
Bonds	$ 5,000,000	5%
Preferred stock	2,500,000	6%
Common stock (par $50)	4,750,000	
Total	$12,250,000	

Total on combined properties.	
Bonds	$11,500,000
Preferred stock	4,300,000
Common stock (par $50)	9,500,000
Total	$25,300,000

Copper.

Habirshaw Electric Cable Company, Inc., and the Electric Cable Company, New York City, in their December pamphlet, The Wire Message, sum up the copper situation as follows:

For the first time in many months it may confidently be said that the uncertainties and perplexities of the copper situation have largely disappeared. During November there was a decided change for the better. The needs of the Government for the near future seem to be better known, though we have seen no authorized statement of quantities. The fact, however, is apparent because producers are releasing copper more freely for deliveries on old contracts. We hear they are accepting no orders for spot copper but are booking contracts for delivery during the first quarter of 1918. This indicates a better feeling regarding supply which is no doubt largely due to the clearing up of the labor situation, and to the fact that there is reason to hope that strikes will not—at least for the duration of the war—seriously reduce production. The most favorable turn in the copper market is that which releases the jobber, and the small consumers who are his principal customers, from an intolerable situation. The agreement between the Government and producers made no distinction between speculators and legitimate dealers. The latter were therefore faced with the proposition of either violating the wishes of the Government, and possibly laying themselves open to legal action, or of disposing of their holdings at the fixed price, which meant a heavy loss.

Under date of November 20, H. M. Brush, secretary of the Copper Producers' Committee, sent a letter to many of the principal jobbers, referring to the agreement between the Government and the producers, which has the following provisions:

1. The copper is to be re-sold in less than carload lots.
2. A charge of not over 5 per cent may be made to cover the expenses of handling and profit.
3. Freight may be added to point of destination.
4. A charge of $2.50 for 1,250 pounds may be made when ingots are shipped that must be packed to conform to the transportation rules.
5. Terms are net cash at time of shipment, or interest at 6 per cent if credit is extended.
6. Sales by distributors are contingent upon their being for consumption by the buyer, and not for resale.
7. Distributors must agree they will not buy or sell in carload lots at any amount over the fixed price

This arrangement refers specifically only to copper to be purchased at the fixed price and not to purchases already made at a higher price. However, the intent of the Government clearly is to allow approved dealers to sell legitimate consumers at a profit of 5 per cent. There is more or less speculation as to what the fixed price will be after January 31, 1918, when the period for the present fixed price expires. Some look for a lower figure, but the consensus of opinion seems to be that if any change is made it will be upward.

Copper Exports for September.

According to figures of the United States Department of Commerce, copper exports to France, Italy and United Kingdom in September totaled 54,577,594 pounds, as compared with 52,220,885 for the corresponding month of last year, an increase of 2,356,709 pounds. Exports to these nations for nine months ended September 30 totaled 675,275,340 pounds, as against 458,316,552 in 1916. Although the increase in September shipments to the leading Allies is small, it compares with a decrease of 4,663,350 pounds in total exports to all countries, which were only 60,601,803 pounds, as against 65,265,153 in September, 1916. The decrease in total is more than accounted for by the falling off in shipments to European Russia, which were 2,989,073 pounds, compared with 10,434,183 in September, 1916. In view of the probable cessation of hostilities in Russia, it is presumable that copper exports to that country will continue restricted during the continuation of the war. The heaviest consignments in September were, as usual, to France. These amounted to 37,484,619 pounds, or more than 60 per cent of the total copper exports. Italy received 9,871,457 pounds, and 7,221,518 went to the United Kingdom. The trade is now expecting heavy further demands from France and Great Britain.

Public Utility Dividends.

Northern States Power Company has declared the regular quarterly dividends of 1¾ per cent on the common and preferred stocks. The common dividend is payable January 15 to stock of record December 31, and the preferred dividend is payable January 20 to stock of record December 31.

United Gas & Electric Company (of New Jersey) has declared the regular semi-annual dividend of 2½ per cent on the preferred stock, payable January 15 to stock of record December 31.

Columbus Electric Company has declared a semi-annual dividend of $3 on the preferred stock, payable January 2 to stock of record December 22.

Washington Water Power Company declared regular quarterly dividend of $1, payable January 2 to stock of record December 15.

Panama Power & Light Corporation declared regular quarterly dividend of 1¾ per cent on the preferred stock, payable January 2 to stock of record December 22.

Westinghouse Electric & Manufacturing Company has declared a quarterly dividend of 1¾ per cent a share on preferred stock, payable January 15. A dividend of 1¾ per cent on common stock for the quarter ending December 31 will be paid January 31. Both dividends are payable to stockholders of record as of December 31.

Harrisburg Light & Power Company, Harrisburg, Pa., has declared a regular quarterly dividend of 1½ per cent on the preferred stock, payable December 31 to stockholders of record December 17.

Westinghouse Air Brake Company has declared a quarterly dividend of $1.75, payable January 21 to stock of record December 31.

Southern California Edison Company has declared the regular quarterly dividend of $1.75 a share on the preferred stock, payable January 15 to stock of record December 31.

Lake Shore Railway and Lorain Street Railroad Companies have been authorized by the Ohio Utilities Commission to extend for two years the payment time of $200,000 bonds outstanding.

Consumers Electric Light & Power declared regular quarterly dividend of 1¾ per cent on the preferred stock, payable December 31 to stock of record December 8.

Reports of Earnings.

CLEVELAND ELECTRIC ILLUMINATING COMPANY.

Cleveland Electric Illuminating Company, a subsidiary of the Central States Electric Company, reports earnings as follows:

	1917.	1916.
November gross ....*$	704,999	*$ 488,802
Net after taxes	232,037	135,911
Surplus after charges and depreciation ...	120,839	45,915
11 months' gross *6,089,289		*4,563,167
Net after taxes	1,812,603	1,997,575
Surplus after charges and depreciation ...	765,921	1,118,981
12 months' gross *6,635,860		*5,013,981
Net after taxes	1,941,713	2,092,668
Surplus after charges and depreciation ...	798,550	1,039,549

*Earnings subsequent to April 25, 1914, are subject to adjustment after decision in pending rate proceedings, the exact result of which cannot now be determined.

ALABAMA TRACTION, LIGHT & POWER COMPANY, LIMITED.

Earnings of Alabama Power Company, operating subsidiary of Alabama Traction, Light & Power Company, compares as follows:

	1917.	1916.
November gross .....$	197,334	$ 151,445
Net after taxes	114,696	89,949
Twelve months' gross.	2,060,147	1,469,441
Net after taxes	1,277,830	918,105

WEEKLY COMPARISONS OF CLOSING BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeiler & Co., Rookery Bldg., Chicago.

	Div. rate. Per cent.	Bid. Dec. 26.	Bid. Jan. 2.
Public Utilities—			
Adirondack Electric Power of Glens Falls, common	..	15	15
Adirondack Electric Power of Glens Falls, preferred	6	68	67½
American Gas & Electric of New York, common	10 +extra	87	87
American Gas & Electric of New York, preferred	6	39¼	38
American Light & Traction of New York, common	..	190	218
American Light & Traction of New York, preferred	6	87	90
American Power & Light of New York, common	4	40	40
American Power & Light of New York, preferred	6	71	71
American Public Utilities of Grand Rapids, common	..	..	27
American Public Utilities of Grand Rapids, preferred	6	..	56
American Telephone & Telegraph of New York	..	99	105
American Water Works & Elec. of New York, common	..	4½	4½
American Water Works & Elec. of New York, particip	7	8	8
American Water Works & Elec. of New York, first preferred	..	57	57
Appalachian Power of Bluefield, common	..	2½	2½
Appalachian Power of Bluefield, preferred	7	18	18
Cities Service of New York, common	+extra	203	206
Cities Service of New York, preferred	6	66¾	66 1/6
Commonwealth Edison of Chicago	8	100¼	102
Comm. Power, Railway & Light of Jackson, common	4	..	31
Comm. Power, Railway & Light of Jackson, preferred	6	..	62
Federal Light & Traction of New York, common	..	3	3
Federal Light & Traction of New York, preferred	..	25	25
Illinois Northern Utilities of Dixon	6	..	76
Middle West Utilities of Chicago, common	2+extra	19	20
Middle West Utilities of Chicago, preferred	6	55	55
Northern States Power of Chicago, common	ex.div. 7	..	60
Northern States Power of Chicago, preferred	ex.div. 7	86½	80
Pacific Gas & Electric of San Francisco, common	5	30½	30½
Pacific Gas & Electric of San Francisco, preferred	6	79	80
Public Service of Northern Illinois, Chicago, common	7	71	70
Public Service of Northern Illinois, Chicago, preferred	6	85	85
Republic Railway & Light of Youngstown, common	4	19	19
Republic Railway & Light of Youngstown, preferred	6	52	53
Standard Gas & Electric of Chicago, common	..	5½	5½
Standard Gas & Electric of Chicago, preferred	6	19	19¾
Tennessee Railway, Light & Power of Chattanooga, common	..	2¼	2¼
Tennessee Railway, Light & Power of Chattanooga, preferred	6	10½	10½
United Light & Railways of Grand Rapids, common	4	27	27
United Light & Railways of Grand Rapids, preferred	6	58	58
Western Power of San Francisco, common	..	7	80
Western Power of San Francisco, preferred	6	40	40
Western Union Telegraph of New York	extra	80	87
Industrials—			
Electric Storage of Philadelphia, common	4	44½	45
General Electric of Schenectady	8	..	135
National Carbon of Cleveland, common	8	56⅛	56⅛
National Carbon of Cleveland, preferred	..	130⅜	130⅜
Westinghouse Electric & Mfg. of Pittsburgh, common	5 +extra	36⅝	41⅜
Westinghouse Electric & Mfg. of Pittsburgh, preferred	7	58	59

*Last sale.